JC Branner

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GEOGRAPHICAL IDEALS.*

By the Rt. Hon. Sir GEORGE TAUBMAN GOLDIE, K.C.M.G., F.R.S., D.C.L., LL.D., President of the Royal Geographical Society.

GEOGRAPHY is an eminently practical branch of knowledge, and it may, perhaps, be contended that it has no place for ideals. There is, indeed, a general aspect of the subject which appeals to the imagination with almost overwhelming force. To explain my meaning, let me first ask and answer the question, What is the *locus* or field of Geography? It is the surface of our globe, in which term we also include the atmosphere and such depths of the lithosphere and hydrosphere as are or have been penetrated or examined by man; so that, to a large extent, it coincides with the *locus* or field of biology, although the contents of the two sciences are, of course, very different. The exactness of my definition may be disputed, but it is sufficiently accurate for my purpose. The entire field of geography is, in any case, only a thin film of air, earth and water rotating and advancing amongst the immensities of the stellar system. But this exiguous film, insignificant in dimensions as compared even with the volume of our small planet, contains all that we know of thought and sensation existing in the universe. Speculate as we may, hope as we may, believe as we may, this minute and whirling field of geography is to us the only place in which, so far as our present knowledge goes, those phenomena exist which differentiate life from inert matter, the only field where the mysteries of reproduction, volition, reason and imagination have their home.

But apart from this general aspect of an awe-inspiring and yet fantastic position, the science of geography is essentially utilitarian.

* An address delivered at the opening meeting of the Royal Scottish Geographical Society in Edinburgh on November 22, 1906.

Why then should it need ideals? The answer, to my mind, is that in order to produce the most effective practical work in any department of life, it is necessary to have ideals; even though we can no more hope to attain them absolutely than the asymptote can actually reach the curve which it is ever approaching. Counsels of perfection are, indeed, so often employed as a reason for ill-considered action, or as an excuse for inaction, that it is easy to understand the impatience with which they are generally brushed aside by the practical but not highly imaginative Englishman; but when they are set up only as goals towards which we should struggle, by paths however devious, by successions of compromises, with well timed haste and with well timed rest, their value cannot be overestimated. I can think of no finer example of this truth than is to be found in the life of David Livingstone, who was at once an idealist and practical worker in the highest degree, and who may also be held to have approached as nearly as human nature permits to our conception of an ideal explorer.

Exploration.—I propose to deal, in the first place, with the ideal explorer, partly because of the occasion which brings me here to-night, the award of the Livingstone medal, but mainly because exploration in the present or in the past is the very foundation on which all geography rests. Whether the term exploration be applied to travel amongst barbarous tribes in the heart of an unknown continent, or to the peripatetic examination of some geographical problem in one's own country, the category of the most effective qualities of character and method remains much the same, however different may be the degree in which those qualities are called upon to be displayed.

With an almost unprecedented store of the more passive qualities of physical courage, tact, patience and endurance, which a long life of dangers, obstacles, privations and sickness could not exhaust, Livingstone possessed an equally remarkable store of those more active qualities—which many men have shown for shorter periods, but which few have been able to maintain, as he did, during decade after decade—the power of initiative, the almost unerring perception of the most effective ways of attaining his objects with the very limited resources at his disposal, the unwearying persistence in pursuing those objects, and perhaps, above all, the moral courage with which he continually risked one of the most depressing of human calamities, failure. With the exception of physical courage and endurance, the need for which in geographical exploration is rapidly disappearing, these passive and active qualities of character will always remain essential, though in a lesser degree, to the investigator of nature abroad or at home.

As regards Livingstone's qualities of method, I would specially deal with his adaptation and cultivation of his mental acquirements for service in every branch of the work which he set himself to perform. Geographers are, perhaps, apt to forget, and missionary societies, at one

period of his life, certainly forgot that although Livingstone ranks as the most notable explorer of modern days, taking into account the great number of years over which his services extended, he was (one may say) born a missionary, he lived a missionary, he died a missionary. He foresaw, when still a youth, that for this work a medical education would be invaluable, a truth which was not so widely appreciated in those days as it is now. The story of his extreme privations and difficulties in obtaining the desired education in surgery and medicine, while barely earning his living in a factory, is at once pathetic and bracing, but my business is only to note that if he had not acquired that knowledge it would not have been a question of his succeeding less completely as an explorer; it would have meant his entire failure at an early stage of his explorations. Of similar character was his thorough acquaintance with the use of tools, which he foresaw would be of some value when he became a missionary, and which proved of incalculable value when he, at a later period, superimposed on that calling the career of an explorer. Fortunately also, for general science, Livingstone had, as a boy, taken great interest in botany, geology and zoology, and had devoted his leisure to searches for specimens in the country surrounding his home. At a later period, he cultivated to his utmost power his acquaintance with these branches of knowledge, with the result that the great value of his contributions from Africa was recognized by the most competent authorities. I need only refer to the testimony of no less a person than Professor Owen as regards Livingstone's contributions to zoology and paleontology, to the repeated tribute which Sir Roderick Murchison paid to his services to geology and physical geography, and to the following remark made by the then astronomer-royal at the Cape. "I never knew a man," said Sir Thomas Maclear, "who, knowing scarcely anything of the method of making geographical observations or laying down positions, became so soon an adept, that he could take the complete lunar observation and altitudes for time within fifteen minutes." I quote this verbatim because it shows the intensity and whole-heartedness with which Livingstone threw himself into any new study which his new career demanded, but the need of which he could not foresee until he determined to abandon his South African mission station for exploration in unknown lands.

The special branches of knowledge in which Livingstone trained and perfected himself are not, of course, all needed for explorers in every part of the world, or in every branch of exploration in its widest and truest sense. The explorer who travels round the shores of Britain to examine the conditions of coast erosion will not need for this purpose the particular mental equipment with which Livingstone armed himself, such as medical knowledge, skill in the use of tools, acquaintance with botany and zoology, ability to take accurate astronomical observations; but he will need, as fully as Livingstone needed, whatever special

acquirements his object demands, and he will approach the ideal explorer in exact proportion to his previous cultivation of the necessary technical knowledge and powers of scientific observation, and to the character which he displays in the pursuit of his labours. Tact, persistence and moral courage are hardly less essential to genuine success in civilized lands than they are in barbarous regions, and it is indeed an open question whether African chiefs, in the days of their independence, were not, as a rule, less unsatisfactory to deal with than the governments of our own and neighbouring countries.

Cartography. — Upon the foundation of exploration, in its wider meaning, geography constructs its basement of cartography on which must rest the entire superstructure of the science, so that our next question concerns the ideals towards which cartographers should advance. Many years ago the late Elisée Reclus, perhaps the greatest geographer of the generation now passing away, strongly advocated before the Royal Geographical Society a method which must, I fear, long remain only an ideal, namely the use of relief globes, or sections of globes, of such dimensions—say on the scale of 1 to 100,000—that even heights of 150 feet would be distinctly shown, without adopting the usual method in relief maps of exaggerating the proportional height of hills and mountains. On globes of such dimensions the geological and ecological features of the surface could also be displayed in considerable detail. After quoting the view urged many years ago by a scientist, whom he justly termed "one of our eminent geographers, Dr. H. R. Mill," that "accurate cartographic representation is the very essence of geography," Elisée Reclus proceeded to point out that "there is only one way to represent truly the surface of the Earth. Curves are to be translated in curves. . . . Therefore are we really astonished that public attention and the special care of geographers are so little attracted towards this logical mode of geographical work." He noted that globes of considerable dimensions—up to the scale of one millionth—had indeed been made for exhibition purposes, but that these had "made no pretence to accuracy in geography proper." He might have added that, on so small a scale, such globes would have been useless for effective hypsometrical representation as regards regions where the elevations were generally less than 3000 feet, so that while Scotland would display some of her beautiful hypsometrical features, England would show a somewhat plain face. It will not be denied that there is immense force in Elisée Reclus's proposals. Under the existing system of education boys are taught to think of the Earth's surface only in terms of plane trigonometry; and although this method is approximately accurate over small areas, it is absolutely misleading when the areas are large, the globes in ordinary use being so small as to make it difficult for a boy to co-ordinate them in thought with the flat maps presented to him of individual countries. Moreover, it is one of the important advantages

of real geographical study, as it is of the study of astronomy, that the mind is trained to think in terms of both spherical and plane trigonometry; and this double standpoint gives the student that stereoscopic view of nature which is essential in every department of thought, if existence is to be appreciated as a solid reality instead of as a flat and unsubstantial picture. The more effective qualities of the average officer of the navy or the mercantile marine (as compared with the average landsman of equal general education) are everywhere recognized, and are, doubtless, due to several concurrent causes; but it does not seem to me far-fetched to attribute them in some part to his studies in navigation which necessitate his acquisition of the habit of viewing space from a double standpoint. In elucidation of my meaning I would recall a remark made to me many years ago by a great philologist that when a man for the first time studies another language than his own, he acquires ideas on language generally which would otherwise have always remained unknown, and even inconceivable to him. One of our leading statesmen invented the happy phrase "Learn to think imperially." I would say to the young geographer, learn to think spherically.

Before leaving Elisée Reclus's proposals for exhibiting the Earth's surface on curves and in relief with the same scale for plan and elevations, I feel compelled to protest, of course with the greatest deference, against the unmitigated scorn and condemnation which he and some other eminent geographers have heaped upon the usual system of relief maps or globes which exaggerate the proportional height of hills. Until we reach Reclus's ideal of globes or sections of sufficient dimensions to depict the true hypsometrical proportions, and until such globes or sections can be so multiplied as to be within reach of every school throughout the civilized world, it is difficult to see how an average boy is to acquire, without the aid of the ordinary relief map, an initial grasp of the morphology of an extensive region. No doubt the use of the ordinary relief map must be accompanied by careful explanation of the difference of the vertical and horizontal scales; but it does not require much imagination in the student to make the necessary mental adjustments. Those of you who have, when bicycling or motoring, used a guide book giving profiles of the roads with a vertical scale several times as large as the horizontal scale, will, I feel sure, confirm this view. My protest arises from personal experience. It was not until, at the age of nineteen, I visited Switzerland and Germany, which, even at that date, possessed excellent relief maps, with of course exaggerated heights, that morphology became a reality to me; and there must be millions who, like myself, have not been gifted with an innate initial power of full realization from representation by projection, where perspective cannot be called in to assist. Once the sentiment of reality is fully established by the aid of relief representations of a region over

which one moves, flat projections become for ever as communicative as they are to those more fortunate persons who are born cartographers.

For the present, Reclus's gigantic globes or sections of globes are not available and we must do the best that we can to improve our flat maps. The ideal flat map would include every datum with which the science of Geography in its most advanced state would deal. It would represent all the great physical features of the Earth's surface, land and water in all their various forms, mountains and hills, valleys, plains, plateaus and depressions, oceans, inland seas, lakes and rivers. It would show both the hypsometrical features of the lithosphere and the bathymetrical features of the hydrosphere. It would indicate in a general way the surface geology. It would mark the average rainfall and prevailing temperature. It would show the main economic or ecological characteristics of regions represented on a small scale, and would deal in detail, on a large scale, with regions calling for special attention; while in wholly undeveloped parts of the world, the characteristics of the surface would be exhibited, such as forest, prairie or other grass lands, desert and swamp. It would indicate the distribution of life in its various forms, showing the leading features of vegetablé life, and the principal types of wild animals, where such existed. So far, however, the ideal map would exhibit only the frame-work in which humanity is set, the theatre on which man has to play his part. To make it complete, it must show the distribution of various types of mankind over the face of the Earth, the boundaries of states, the density of population, and to some extent the general results of man's interference with natural conditions, or what is generally regarded as political and economic geography. I do not pretend to have exhausted all that it should exhibit. I have only pointed out leading features that it should not omit; and I may sum up by saying that the ideal map of a region should contain in cartographical symbols all the information which would be necessary to a student who wished to write a complete geographical memoir of the region; for cartography is the basis of all sound geography. Such a map is at present only an ideal which should be striven after by all conscientious and competent cartographers, as far as is now practicable. The question of the best methods and symbols to be employed must be left for discussion by cartographical experts, who appear, however, to have widely differing views on the subject; but criticism is permissible to those who have not constructive or creative genius, and I may point out one method which is clearly unscientific. One has seen maps issued from time to time under the title of commercial maps, and professing to show the distribution of products and industries, in which the names of these seemed as if they had been distributed over the sheet by means of a pepper box. Horses, silk, cattle, iron, sheep, grass, pigs, wheat, wine, and scores of other names

were scattered in a haphazard fashion, which not only failed to inform, but actually misled any one unacquainted with the regions represented.

One of the most difficult tasks for the cartographer seems to be an adequate representation of the hypsometrical features of the Earth's surface. For certain purposes the contour map is very useful, especially if, as in the Swedish Official Survey map, each contour is shaded with a gradually intensified tint of brown from the sea-level upwards. A very effective method of contouring is that which Japan adopted some twenty years ago, and which is now used in the United States Geological and Geographical Survey. This consists of lines in a tint of brown so arranged that at a slight distance it produces the effect of excellent hill shading: while, on close inspection, one is able to read the contours. Perhaps, however, the best result is produced when really good hill shading is used in combination with contours, as is the case with the Swiss Survey maps. This method shows very clearly the lie of the land, while one can also read the contours from the lowest level to the highest. Another very good example of this method is the map of Tunis, on a scale of 1 to 50,000, which has been recently published by the French Intelligence Department. I feel that it might be invidious to mention by name any particular cartographical establishment in these islands, or even on the continent of Europe, but I have little doubt that most of you have already made up your minds as to which, on the whole, are the most useful as well as the most artistic Atlases available in the United Kingdom. My chief fear is that the majority of the general public who have not yet been reached by the geographical training so rapidly spreading on improved lines all over the country, may form their estimate of atlases on their cheapness or on their quantity and not their quality, or on the number of names which are to be found in their indexes. Other things being equal and subject to there being no sacrifice of clearness, a large number of names is an advantage, but if they are divorced from their natural physical and economic setting they convey very little real information. I hope that the time has passed when it was thought that any production was good enough for a school map or a school atlas, and that we are alive to the obvious fact that the maps on which children are trained have no less importance than those which are for the use of adults. It may not perhaps be practicable to produce an atlas in which all the maps are on the same scale, but some confusion in juvenile minds might perhaps be avoided if the maps were all on a multiple or a measure of a standard scale. It will, I think, be generally agreed that there is room to-day for even a better atlas than any now existing, and we can only hope that with the spread of geographical education the necessary encouragement may be given to publishers to expend the large amounts which the production of a first-class atlas would undoubtedly require.

Geography in War and Peace.—To whatever point of excellence cartography may be brought, however, it can never be more than a means to an end, excepting to a small number of artistic minds to whom a really fine map is a thing of beauty and a joy for ever. The same principle applies to geographical knowledge generally, which may be its own reward to a few detached minds, but which will be estimated by most men at its practical value to mankind. A few words must therefore be said as to their most important uses in war and peace, and we may possibly find some ideals at which we should aim in these directions. I put war first as the primitive state of mankind and not yet entirely out of date. It is a moot question whether war is more useful to geography or geography to war. The proposition that war has been one of the greatest geographers has been so frequently expounded at length and is so obvious to the student of history that I need not dwell upon it in this brief address, only remarking that it is interesting to find the conviction of its truth existing even in the United States where, more than in any other great country, the development of geographical knowledge and peaceful expansion have gone hand in hand.

During the Spanish-American war a well-known scientific authority, Prof. Chamberlin of Chicago, pointed out that the war might be expected to produce a great revival of interest in geography throughout the United States. He concluded: "It was observed at the close of the Civil War that those who returned from its campaigns possessed an appreciation of the elements of position and physical relationship quite beyond that realized by the preceding generation educated under the benign influences of peace." We now know that Prof. Chamberlin's forecast was correct, the Spanish-American War having given an undoubted acceleration to the progress of the geographical spirit in the United States similar to that which he tells us was observed after the Civil War.

The value of geography in war, on the other hand, may perhaps be best brought home to our own countrymen by recalling the enormous expenditure in which the want both of maps and of geographical training of our officers indirectly involved us during the Boer War. I can speak confidently on these points from having served (for nearly a year) on the Royal Commission on the South African War. It is a matter of deep regret that, during the many years of peace and colonial expansion at the close of the last century, Great Britain did not expend a moderate sum annually in mapping the unsurveyed portions of the Empire. We should not then have found ourselves attempting to relieve Ladysmith or advancing to the Modder river without maps of the country. It is only fair to add that the lesson of the war, in this respect, has not been altogether forgotten. During the last four years a certain amount of money has been expended in imperial mapping of hitherto unsurveyed regions; and if this process is not altogether

arrested by a spirit of false economy, we may possibly at some distant date possess fairly adequate maps of all British possessions. That is at any rate an ideal which we should strive to attain. As regards the want of geographical training of our officers, I have not time to cite the mass of evidence given before our Commission by the most competent authorities as to the general deficiency in knowledge of ground, than which, as Lord Roberts and others pointed out, nothing could be more important in war. Even as regards staff officers, who have considerably more training in this subject than the ordinary regimental officers, Lord Roberts was often struck with their inability to read maps well or to explain quickly and intelligently about the contours and elevations. In this respect our ideal should be to reach the level attained by Japanese and German officers.

Geographical ignorance is a costly luxury in times of war, but it is perhaps still more costly in times of peace. No estimate, even of the roughest kind, can be formed of the vast sums that have been wasted in modern days through States collectively, on the one hand, and individual settlers, on the other hand, attempting to produce grapes from thorns and figs from thistles.

This subject of the practical uses of ecology, or economic geography, is far too large to be treated here incidentally; it would require an address or rather a series of addresses to itself. A mass of literature on the subject already exists; but this will probably be read only by specialists, or by those who can give a good deal of their time to scientific geography. For others, the best short manual on the general question is still, to my mind, that entitled 'Applied Geography,' by Dr. Scott Keltie, who is recognized, both at home and abroad, as one of the most capable and best informed geographers of this or any other country. I understand that he is a Scotchman; and as I am speaking to a Scottish audience, I may briefly refer to the splendid ecological work that Scotland has done in the exploration, settling and development of those vast regions known as the Dominion of Canada, which have before them so assured and so great a future. The part that Scotland has played in that work up to 1882 is, I think, best told in Mr. Rattray's 'The Scot in British North America,' which many of you will have read. I may say that it was lent to me by a very distinguished Scot, whom the rising generation probably know chiefly as the Lord Strathcona, who raised and equipped Strathcona's horse during the Boer War, but whom older geographers remember as the Donald Smith who played so important a part in the development of the North-West regions. I need hardly remind you that from Canada comes another Scot—Sir John Murray—who is, admittedly, the greatest oceanographer and limnologist that the world has produced; that the most successful settlement in South Africa was the Scottish settlement in Cape Colony; that Natal is a second Scotland; that the acquisition of

British rights in East Africa, which promises to show important ecological results, was due to the efforts of the late Sir William Mackinnon, and was largely the result of the explorations of Joseph Thomson; that the province known by the misleading name of British Central Africa was opened up to commerce by the Scottish African Lakes Company, and was made into a peaceful British possession by the first recipient of your Livingstone Medal, Sir Harry Johnston; or that, a century ago, the marvellous travels of Mungo Park were the genesis of the entire movement which has opened up Africa to civilization. It must, I think, be admitted that Scotland was in the forefront of the great geographical and imperial movement of the nineteenth century. Nor has she neglected the more purely scientific sides of geography, as was evidenced by the recent successful national expedition to the Antarctic Regions; while her cartography, as represented by Keith Johnston and Bartholomew, has undoubtedly led the way in these islands. I trust that this vigorous and practical geographical spirit may long endure and, if possible, increase. Although the era of exploration, in the conventional sense, is drawing to a close, there is an unlimited field open for scientific exploration and economic treatment. Mankind has hitherto dealt with the surface of Mother Earth in a haphazard, a hand to mouth fashion, without much scientific study of the varying ecological conditions in different localities, due to the various combinations of slightly differing climates, soils and other geographical data. Is it an unattainable ideal that scientific changes in the distribution and methods of production may some day raise humanity, so far as material comfort is concerned, as much above its existing standard as this is above the material condition of the ill-clothed, ill-sheltered, ill-fed denizens of these islands at the commencement of our present era?

Education.—Whatever may be the proper aims of geography as a science of the utmost value, both in war and in peace, sound and extensive geographical education is an essential condition of advance towards those aims, and the question at once confronts us as to what should be our educational ideals. You will remember that, after the Household Suffrage Act, Robert Lowe gave the celebrated advice, often attributed to Lord Beaconsfield, "Let us educate our masters." By our masters Mr. Lowe meant of course the masses, and the nation have had the question of the education of the masses with them for a whole generation; while—at any rate south of the Tweed—they seem likely to have it with them for some generations to come; but I venture to repeat here, what I have often urged elsewhere, that on many subjects, of which geography is one, we need in the first place to educate the classes. This may not be an unattainable ideal, though it is still distant.

In an address which I delivered at York last August before the British Association I pointed out the advance during the last quarter of a century in the interest in and appreciation of geography displayed by

the governing classes. A case of atavism, recently brought to my notice, makes me fear that I was too sanguine as to the permanence of that advance, at any rate in one important quarter.

In November 1899, regulations were laid down for the examinations for the Foreign Office and Diplomatic Service, which naturally (and I believe merely in repetition of earlier regulations) made geography an obligatory subject. A notice has lately been issued, to come into effect after July 1 next, under which geography will not only not be obligatory, but will altogether cease to be one of the subjects of examination. I have not time to give you a list of the many other subjects for which marks will be given to candidates, and which do not seem to be as important as geography to a Foreign Office clerk or to a Secretary of an Embassy. I will only select six rather striking examples: Animal Physiology, Physics, Chemistry, Moral and Metaphysical Philosophy, Sanskrit Language and Literature, and Zoology, which, of course, may be useful if the official spends his leave in a country where big game is plentiful. In these six subjects the candidate might make 3600 marks out of the maximum of 6000, which he is not allowed to exceed; while not a single mark is given for Geography. One is reminded of Mr. W. S. Gilbert's "Pattern of a modern Major-General," in 'The Pirates of Penzance,' who was an adept in every branch of human knowledge, excepting tactics and strategy.

The urgency of the case impels me to narrate an interesting incident not yet published, especially as the principal actors in the scene are dead, so that no one's feelings will be hurt by the narration. A good many years ago a territorial arrangement with France was in discussion, and I was invited to consider it. The French proposals appeared to the Foreign Office satisfactory; but I found that they were expressed, as might have been expected, in longitudes reckoned from the meridian of Paris, while the map with which our Foreign Office had considered these proposals was made in Germany and reckoned its longitudes from the meridian of Greenwich. The arrangement in question was never completed.

This was an instance which came under my personal observation, but it is a matter of notoriety that some of our most serious international disputes of recent years have arisen from the faulty geographical knowledge of the negotiators of treaties in the darker ages. I believe that our Foreign Office and Diplomatic Service for years past have been filled with men of considerable geographical knowledge; but this improved condition will not last if geography is to be eliminated from their examinations, and Great Britain will see its future diplomatists contending with bows and arrows against foreign diplomatists armed with the best weapons of the twentieth century. The most serious feature of the case, however, is that such an official denial of the national importance of geographical education is to-day possible. It shows the immense obstacles that still confront our Geographical Societies before

they can make great and lasting advance in what seems to me one of their most urgent duties, that of educating the classes of Britain.

Turning from this fundamental postulate to the general principles underlying a sound geographical education, I should like to put before you the substance of a most interesting letter on the subject which I have recently received from Mr. H. J. Mackinder, Director of the London School of Economics, and whom you know to be one of the highest authorities in Britain on Geographical Education. I have only time to read extracts; so that you will not hold the writer too closely to passages given without their context. He says, "Geography must not be thought of as a mass of information merely, or indeed chiefly. Its distinguishing characteristic, giving it peculiar value as a discipline, is that it has its own special point of view and mode of thought and of memory. The geographer thinks in spaces and shapes. So far from names being material to the subject, even words are not essential to geographical thought. . . . In the elementary stage the teaching of geography should not adhere pedantically to any method. The main point is that a few things should be vividly and rationally taught. Such precision as is involved in the use of latitudes and longitudes should be eschewed, unless in the highest standards. No doubt nature-study should come first, but it must not be substituted for geography, for which it only prepares. . . . In secondary education the teaching of geography should, I think, be more methodical and precise, but what is chiefly important is that it should be progressive in method. Geography may well serve in this stage for the purpose of correlating subjects, both scientific and historical, but the more that such a function is assigned to it the more necessary does it become to have a clearly defined and strictly geographical argument running through the whole of the teaching. In other words, the geographical point of view must be dominant, and not the view points of this or that auxiliary science. . . . In the University stage, geography should be studied both from a specialist and from a general standpoint; that is to say, that while it is a condition of progress in our knowledge that we forsake the whole field and concentrate on some part of it, yet it is only in the university stage that what I may describe as the philosophy of the subject can be fully appreciated. It is essential, however, that the specialist should already have firmly acquired the geographical method and the geographical point of view. Until secondary education in geography is more generally thorough, I fear that the University teacher of the subject will have to teach much which in a future generation will have been learned by his pupils before they come to him. To my mind, by far the most important function of the University teacher of geography in the present and immediate future must be to produce a considerable number of good secondary teachers of the subject, and to establish a tradition of geographical school teaching. The danger of the moment is that in

view of the sudden demand for school teachers of geography which has recently sprung up, we shall be tempted to equip and employ persons of inferior general education and mental power. Geography requires in the teacher both a firm grasp of principle and a broad outlook. With these qualities, I believe that it can be made a discipline of the highest order, but no subject is so easily reduced by an inferior teacher to a low pedagogic value, worthy of all the contempt that has been poured upon it."

Although Mr. Mackinder's remarks in this letter proceed from elementary teaching upward to the university, we know that he is in full accord with the policy followed by the Royal Geographical Society during the last twenty years, of regarding recognition of geography at our great universities as the first and most important step in impregnating the country with a geographical spirit, and of working downward from there into the masses of the nation. As I dwelt on this question at length in my York address, I will only add that it now seems certain that the Welsh University will shortly have a Reader in Geography, and that I cannot doubt that Scotland will succeed in her present efforts to endow a Chair of Geography at the University of Edinburgh, which has, I understand, done all in its power to facilitate such a measure. It would, indeed, be extraordinary if this country, which, as I have just shown, has been in the forefront of the great geographical movement of the last century, should allow herself to be permanently distanced in this one direction—admittedly of the highest importance—not only by Oxford, Cambridge and London, but also by Manchester, Birmingham and gallant little Wales.

Amongst the minor methods of arousing interest and imparting information in geographical matters, perhaps the most effective is the comparatively modern use of photographic lantern slides. For either purpose the value of accurate and artistic visual representation accompanying aural explanations can hardly be over-estimated, whether the spectators and audience are trained geographers or elementary school children. Even so lately as thirty years ago geographical lectures were generally dreary affairs—except for the enthusiastic few—unrelieved, as they were, by pictorial representations. I feel very keenly the disadvantage I am under, or rather that you are under to-night, through my having no slides; but there was no remedy; for although photographs have, I am told, been taken of ghosts, no one has yet attempted to photograph an ideal. When we consider the instruction of children the necessity becomes still more evident of interesting the eye as well as the ear; and I hope that this principle will be more and more understood in our schools, in many of which the study of geography still consists of learning strings of names. The method of visual representation has, indeed, spread greatly during the last decade; but it does not yet cover a tenth of the field that it might usefully occupy. I believe

this is partly due to the cost and difficulty of getting good slides, and I may be doing a service to some who wish to interest and instruct their fellow-parishioners in the country by drawing their attention to the series of the Diagram Company, whose address is West Barnes Lane, New Malden, Surrey. I could not, of course, mention this Company if they had been formed for purposes of profit. I am told, however, that their objects were scientific, and that they do not at present cover their expenses. Many of you, doubtless, know their excellent slides. We have a complete series in Savile Row, and I understood that one was kept at the Outlook Tower in this city; but Prof. Geddes tells me that this is not now the case.

Another minor educational ideal is that all books involving movement from one geographical locality to another should have sketch-maps attached to them. This principle applies especially to works of fiction, which reach a far wider public than is the case with serious books. When we re-read the Waverley Novels after reaching maturity, and with a knowledge of the positions and surroundings of the localities dealt with, we cannot avoid regret that our childish interest in each of them was not quickened and our knowledge insensibly increased by a simple sketch map on the frontispiece. This stimulating power of pictorial representation is perhaps most clearly demonstrated by a case in which the map was as imaginary as the text. How much of the interest of Treasure Island would have been lost but for the immortal map with which Robert Louis Stevenson enriched it! Stevenson, indeed, was deeply imbued with the geographical spirit, and in several books—I can particularly recall 'Kidnapped'—produced real maps which greatly assist the young reader. Half a century ago, even history—ancient, mediæval and modern—was read in the best schools without any reference to maps, with the result that most of us had to endure the loss of time in re-reading, when grown up, a mass of works which we had literally, but not geographically, mastered in our youth.

I have reserved to the last the few words I need say on the most vital and far-reaching of all instruments of geographical education—I mean societies such as this. They have afforded means of higher and ever-extending knowledge even to the most instructed of their Fellows; they have encouraged the geographical spirit amongst their less zealous members; they have been the chief authors or supporters of all other modern means of improvement in geographical education; while the rôle that lies before them is even more important than that which they have hitherto filled. That is why I am here to-night; and if I might add one more ideal to my list of geographical ideals, it is that every educated man in Scotland should join your Society, and, by his contributions to your funds, enable you to extend and intensify your work in promoting a branch of knowledge which is one of the most important, if not the most important, of the material sciences to the future welfare and progress of mankind.

JOURNEYS IN SOUTH-EASTERN MASHONALAND.

By VINCENT DICKINS.

In the beginning of July, 1904, I was deputed by the Rhodesian Government Native Labour Bureau to proceed on a tour of exploration and investigation throughout South-Eastern Mashonaland in the country lying between 20° and 23° S. lat. and 29° and 32½° E. long., to ascertain and report on the possibilities of obtaining native labour within that area for work on the Transvaal mines. In consequence I had the opportunity of going through a part of Rhodesia practically unknown and uninhabited by white men, and took advantage of my travels (which, together with other exploring expeditions I have since made in the country, have extended roughly over something like 3000 miles) to map the country and note its general features. The results of my investigations and travels extending over the last eighteen months, in which I have taken a great interest, I now beg to lay before the Society, together with a map of the country explored by me. By comparing the latest map of Rhodesia obtainable, published in 1900, with mine, it will be seen that many parts of it are altogether wrong and out of place, especially as regards the rivers.

My most important discoveries are as follows:—

1. The Cheredsi river, rising in watershed 20° S. lat., does not run into the Umtelekwe river, but, after many windings south-east, becomes a big tropical river and runs into the Sabi river below 21° S. lat.

2. The Turugwe river also, instead of running into the Umtelekwe river, empties itself into the Sabi.

3. The M'Gigie river, not shown on map at all, runs into the Sabi.

4. The Makurie river, not shown before, also runs into the Sabi.

5. The Umtelekwe river, running south-east from Victoria district, does not empty itself into the Sabi river, as shown on Stanford's map, but into the Lundi river, near 21° S. lat. and 32° E. long.

6. The Umshabetsi river, 21½ S. lat. and 30° E. long., does not run its course as shown, but in the form of a snake, as I recently crossed its dry bed six times in one day when coming down south-south-west. Water is only obtainable from holes in the sandy bed.

7. South of the Limpopo river, the Engekley river, shown as emptying itself into the Limpopo at 30° E. long., instead joins that river near 31° E. long.

8. The Portuguese border.

I find, on crossing the Sabi river at its junction with the Lundi river south of 21° S. lat. and east of 32° E. long., that the east bank of the Sabi going north for a distance of about 12 miles is Portuguese territory, not British, as shown on Stanford's map, as, after leaving

the kraal at junction with Lundi, I travelled about half a day up the eastern bank of the Sabi river before coming to the ditch, of about 3 feet in width, which has been cut right across the country down to the Sabi and the native state, and which is the Portuguese new border.

On my first journey, I started in the beginning of July, 1904, by a native footpath leading due south from Victoria, the small frontier town which I made my headquarters. I travelled through a country thickly populated by natives;—a very rugged mountainous country fairly well watered by rivers and fountains, with vleis or large tracts of boggy land in many places, which in the wet season would be covered with a few inches of water. The natives take advantage of this to plant rice, and also on the banks of the rivers where the soil is suitable and the rivers have a certain amount of water in them all the year round, being unlike those in the south, which run nearly dry in the summer, and in which water can often only be obtained by digging in the sandy beds. The Limpopo, Umzingwane, and Bubye rivers are notably of this kind which dry up quickly.

The natives in nearly every instance in Mashonaland build their collection of huts or small villages high up in the mountain or hilltop, or else just at the foot of them, where also in the near vicinity they clear the ground of small bush and grass, cutting off the branches only of the trees, leaving the trunks standing bare. Their fields in consequence have a very peculiar appearance with their forests of dry masts. In these they plant and raise mealies or Indian corn, a small round red grain called repoko or requesa, which is their staple food; also another kind called inyoate or muga, which is a small elongated green seed much like hemp in appearance. The Mashona race, which are known amongst themselves as Makalangas, also raise yams or sweet potatoes, monkey nuts, melons, and pumpkins of many kinds, one of the last, when dried and emptied of its contents, being used as their water-calabash universally throughout the country. The natives are very rich in cattle, sheep, and goats, which thrive very well on the sweet grass of the country.

I continued for some days through such country until I reached the Lundi river, crossing on the way the Tokwe river, which always has plenty of good water in it. From here I decided to make my way right down the right bank of the Lundi as far as possible, and try to get to its junction with the Sabi river. I therefore travelled by native footpath, east along the south bank, and the path was a most difficult one owing to the rocky nature of the ground, and heavy thorn bush and long grass. It is a big river 500 or 600 yards wide, with steep banks, in some places the bed being very rocky where the river passes through the mountains, in other places great stretches of sand with pools intervene. In the vicinity of the river, whatever the country beyond may be like, it is generally very thick thorn bush along its banks, with,

in some parts, great shady trees with almost black leaves overhanging the river-bed, in which the reeds rise to great heights; I have seen them nearly 20 feet high. The grass in the vicinity of the Lundi river and throughout the country stretching away south to the Limpopo river is of the short curly variety up to about 2 feet in height, which nearly always has a little green near its roots, however dry it may appear to be. This is very sweet and a most excellent feed for cattle; it is known as buffalo grass.

I continued down the Lundi through an increasingly difficult country, in which travelling was very slow, owing to the density of the thorn bush and thorn trees, many of them of a large bright green variety which grow very tall; I believe they are the real camel thorn. Every day or two I would come upon open park-like country, stretching away south—in all directions as far as one could see nothing but straight leafy mopani trees, with buffalo grass as a carpet; this country was always infested with the mopani fly, a very small tiresome fly which buzzes in swarms about one's head. I often came on herds of big antelope and the smaller varieties in or near these openings in the bush; in the river itself many of the large pools contain hippo, and crocodiles abound everywhere. Lions and leopards, many kinds of wild cats, jackals of several kinds, and hyænas are all very plentiful near the river. Lions are always to be found in the vicinity of the larger kinds of antelope, which they live on.

The language of the natives, which on the north bank is Makalonga or Mishorm, is now changed to Shangaan, a kind of Zulu, which is in general use right down the lower Lundi and Sabi districts and the vicinity of the Limpopo river and northern Transvaal. Riding as much as possible, but often having to dismount and walk for some distance owing to the density of the thorn bush and native footpaths not being made to accommodate horsemen, I gradually worked my way down the Lundi. When I had reached to within about two days of the junction of the river with the Sabi, I found it impossible to get through the jungle any further on that side of the river, and in consequence crossed over to the north bank and found a path going north-west, which I followed for some distance, until I came across another going south-east, which I took and thereby reached the junction of the two big rivers. I was surprised to find a big clearing in the jungle here, and a very large Shangaan village, the largest I have yet seen. The chief's name at the kraal was Hotezaan (previously Matiti). The natives appeared of a superior class of Shangaan, and to be well off, with plenty of cattle, grain, tobacco, and sheep and goats. The Sabi river has a very grand appearance at this spot, being quite a mile wide from bank to bank when in flood, and much wider a little lower down; but at the season of the year when I was there, the water visible in the centre of the stream would be only about 100 yards wide and from 2 to 4 feet deep, the rest being

one great stretch of sand and reeds as far as one could see. I noticed much wild cotton and rubber in this vicinity, and many wild fruits which I had never seen in any other part of Mashonaland. Great quantities of enormous fig trees and other timber lined the river-banks, and afforded shelter to great numbers of noisy birds of the parrot tribe, also the very widely distributed goaway birds, which I have seen all over Rhodesia.

From the kraal on the junction of the Lundi and Sabi, I crossed the Sabi into Portuguese territory, and found the country more open on its north-east side, with great quantities of large mopani trees, and, in between, large clearings used as native grain-fields. Very few kraals were visible close to the river, but I heard from the natives that many were scattered about the country not far off, and the district was well inhabited, the native tribes in the vicinity of the river and eastward being Shangaans, gradually merging into Inhambanes towards the coast. Continuing for half a day's march up the eastern bank of the river, I came to the border-line, and again crossed into Rhodesian territory. After travelling along the bank of the river for two days in fairly open cultivated country, I crossed the river and continued up the western bank for some days; many of the views I obtained from different points were absolutely beautiful, the water in the river, visible here and there in pools, with green foliage round about, looking like a string of lakes in the distance. Then I left the Sabi, near some rapids, and taking a north-westerly course, crossing through a very dry bushy country, I came to the Cheredsi river, with very high banks and sandy bottom, which I crossed at Siduma, and proceeded up its westerly bank for a couple of days. Going west through a very hilly country, I reached Magnatis, on the Umtelekwe river, which I crossed over a very rocky bottom, and, still going west about a day's distance, came again to the Lundi river. I reached this river just at the point where the Tokwe river runs into it at Mulungu's, and made a temporary camp there. At this spot I saw larger numbers of the beautiful and slender-legged impala antelope than I had seen anywhere else in my travels. There is a very big population of Makalanga natives scattered about in kraals between the Lundi and Sabi rivers. These natives, men and women, shave their heads entirely, with the exception of a small fringe in front, or small tufts dotted about in various patterns on the top.

They are an agricultural race, who do not take kindly to mining, especially underground work. Witchcraft is believed in to a great extent amongst them, especially throwing the bones. Passing through the country, one sees great stretches of ground under cultivation for grains; from these they make large quantities of native beer, known as "doro," which they never think of being without when there is any hoeing or planting to be done. They understood the art of weaving cotton into blankets in the early days before they could


Sketch Map of
SOUTH-EASTERN
RHODESIA
BY
VINCENT DICKINS.
Scale 1: 3,500,000 or 1 inch = 55·23 Stat. miles.
Roads
Native paths
Railways
Telegraph
Ft. Charter
Sebakwe
CHARTER
GWELO
Ft. Gwelo
Main Coach Road Bulawayo to Salisbury
Chilimanzi
Gutu's
Makoweries
Selukwe
SELUKWE
New Umtali
UMTALI
Mountainous Granite country
Devule R.
Old Road
Melsetter
MELSETTER
VICTORIA
Zimbabwe
Chibis
Ft. Belingwe
Ft. Filabusi
BELINGWE
Zitarara
Ndanga
Nakonda
Botwas
Malilanga
Chwamba
Siduma
Chiwoke
Mahainea
Macwendo
Sabi R.
Lundi R.
Umpapas
Bombolas
Panyoka
Matombo
Segalo
Ft. Tuli
TULI
Limpopo or Crocodile R.
Mesina
Sekundu Kop
ZOUTPANS BERG
TRANSVAAL
PIETERSBURG
PORTUGUESE EAST AFRICA
MATABELELAND
MASHONALAND
Nuanetsi R.
Bubye R.
Limpopo or Bembe R.

buy them from traders, but now seem to have entirely forgotten it. There are a certain number of kraals in the country where men understand the working of iron, and manufacture it into hoes, axes, and assegais. Most of them are armed, and carry a gun, battle-axe, and assegais. They manufacture their own powder, caps, and projectiles. These natives did not rebel at the time of the last Mashonaland rebellion, and so were not disarmed like the natives in the north-eastern part of the country or Matabeleland. They are fairly peaceable, however, although inclined to be cheeky at times, and say they carry arms for self-defence against the wild animals, such as lions, leopards, hyænas, etc., which are very common in the lower parts of the territory.

I afterwards left this camp at the junction of Tokwe and Lundi rivers, and worked my way across country several hundred miles to the North Danga district, which is very thickly populated with Makalangas, and from there up to Victoria Town, my original starting-point, travelling all the time through a very mountainous granite country, with many good rivers containing running water, which I have shown on my map.

In April, 1905, I left Victoria with a small expedition for Pietersburg in the Transvaal, a distance of something over 400 miles by the route I took. I passed through a country which is hardly known at all—very wild, no white inhabitants, fearfully dry between the rivers—and by a road almost entirely overgrown, which has not been used for nearly eight years. I came down by the Victoria-to-Tuli old coach road, and reached Fort Tuli, a police post of the British South Africa Company, on the Shashi river, in about fourteen days. (I was travelling on foot, as police regulation did not allow animals from Rhodesia to cross into the Transvaal.) From Tuli fort I made my way in two days to the Limpopo river, which I crossed at the Pont Drift, where there is a small post of the South African Constabulary, it being their most northern station. I left there for Pietersburg, the most northerly town in the Transvaal, 200 miles distant, and passed through a country of great dryness, hardly any water except in holes, and that bad, and wherever any trees were visible, they were sure to be some of the thorn variety. I reached Pietersburg in ten days, and purchased a horse, returning to the Limpopo river, following along the northern line of the Zoutpansburg mountains, through another waterless and uninhabited country, and reached Main Drift, where I made a camp. Later I moved 100 miles lower down the Limpopo river, passing on the way a very big stretch of rapids, extending for about 20 miles, with small intervals of sand between.

On the latest published map, the roads in south-east Mashonaland are marked very prominently, but they are so overgrown with grass, bush, and in many parts trees, that it is very difficult to discover that a road has ever existed in the vicinity. Rank vegetation springs up so

quickly in the country after the rains that the roads, which have not been used for many years, are soon covered. The old drifts, on the various big rivers I have crossed, are certainly not in a usable state for waggons without a lot of repairs being made. Baobab or cream or tartar trees of great size are very common over the whole of South Mashonaland, below the Lundi river and in the Northern Transvaal. During times of scarcity of food, as at present, amongst the natives, they live very largely on this fruit and many others they find near the big rivers.

Generally speaking, large and small antelope of nearly every species are met with in the vicinity of the big rivers, also guinea-fowl, pheasant, and sand-grouse. Quagga or zebra are found in the flats near the Nuanetsi river, and between the Bubye and Limpopo rivers. Giraffe also can be found about one day's travel south of Lundi river. Buffalo and rhinoceros still remain in small numbers in the jungle at the junction of Sabi and Lundi rivers. Hippo are very plentiful in the lower reaches of the Limpopo river. I have recently come across good numbers of a blue variety of guinea-fowl which up to the present have been supposed to only be located near the Zambezi river and lower reaches of the Sabi. I discovered them in the lower vicinity of the Limpopo, just before it leaves the Transvaal and enters Portuguese territory.

The chief features of the country which impress themselves on the traveller are the large number of granite hills and mountains spread over the whole country. A gold belt of white quartz and gravels of about 20 miles in width traverses the country in the vicinity of the town of Victoria, running east and west, and gold is met with in an alluvial state in the Tokwe and Lundi rivers. South of the Lundi, banket or conglomerate is thrown up in great quantities. In the flats to the south of the Bubye and Umzingwane rivers, right down to the Limpopo, coal, volcanic rock with limestone crystals in it, agates, garnet rock, and a great variety of mixed and broken formation are distributed. In the vicinity of the Limpopo and its bed are to be found great masses of marble-like rock, with wavy lines of all shades of pink, red, green, blue, and yellow running through them; those in the river-bed, being highly polished with the action of the water, have a very pretty appearance. In the lower part of the country, towards the Portuguese border, there must be at least 100 square miles of land and mountain that have been covered by the sea, apparently at no very distant date, as masses of water-worn pebbles in great variety are deposited everywhere on the tops of the hills, some of them hundreds of feet high, and appear, by the way they lie, as if they were only left yesterday when the water receded. The land in the vicinity is only about 400 feet above sea-level.

Coal has been found in the vicinity of Tuli, and copper in the form

of ancient workings near the Limpopo at Main Drift. This is now being opened up by a company. Coal has also been discovered not far distant from the mine, both of which are in the Transvaal. Owing to the great dryness of the country in South Mashonaland and Northern Transvaal, very little prospecting for minerals has been carried out so far, but the country is believed to be rich and in certain parts diamondiferous.

South-east Mashonaland is well wooded, for the most part with the Mapani tree, which also appears in a stunted scrub bush form. It is a very hard yellow wood, with dark brown core, and is impervious to the ravages of white ants. Native mahogany and boabab trees are found on the mountains; giant fig and palm trees, and also other large timber trees, in the vicinity of the big rivers. The whole country through which I have passed is more or less covered with thorn bush, in a great variety of kinds, straight and hook thorns, which makes travelling by the narrow footpaths very unpleasant, often dangerous. The natives tap the palms, both long and short, for the sap, which is very sweet, looks like water, and is very intoxicating. The wild marula plum they also cook and obtain a very similar liquor from.

Whilst travelling along the north bank of the Limpopo, I came across, east of Middle Drift and about 6 miles distant, an ancient fortified kopje or hill, the fortified walls, which were in good condition, being constructed of blocks of granite similar in size and appearance to those used at the famous Zimbabwe ruins which I recently visited, and the defences arranged in a similar way. This fort is not shown on any map.

The language of the Makalanga natives, who principally inhabit Mashonaland, is a very similar language to Swaheli, the one in general use in East and Central Africa, and as they have a very Semitic appearance, it is generally supposed that they originally came from the north of the Zambezi river. The Shangaan natives near the Lundi, Sabi, and Limpopo rivers speak a different language of the Zulu family. The Mavendi in the vicinity of Limpopo and Northern Transvaal speak a kind of Basutu. The Matabele language is also practically the same as Zulu. The natives generally throughout the country are a lazy lot, who would not go away to work at all if they did not have to find money to pay their hut tax; but the farther east one goes the better the natives, Shangaan and Portuguese, are for mining purposes.

In conclusion, I may say, that after a residence of nearly eight years in Southern Rhodesia, during which time I have been in all parts of the country and had a vast amount of malaria fever, and blackwater fever on two occasions (within three months), at present, owing to the unhealthiness of the country generally outside the towns, and Mashonaland specially, it is hardly the place for a white man to choose to settle down in, and make a home like the other English colonies. One cannot make farming pay, as the expenses are great and the natives can raise

all the grain required far cheaper than a white man, who can trade it from them and then sell it. This is generally done in preference to white men attempting to grow it. The country is very suitable for cattle and sheep farming, the grass being sweet and cattle thriving well on it. Many more farmers would settle and go in for it if the various cattle diseases the country has lately been visited with could be got rid of permanently.

Gold-mining is gradually increasing throughout the west and north of Mashonaland and Matabeleland, which districts are more populated by whites than the south-east, and it is supposed on the best authority that there is a good mining future before the country. The distances between towns are so great and the expense of moving about very heavy, and very little doing in the country generally, therefore many good men who otherwise would have remained in the country have left for the Transvaal, and Rhodesia is the loser.

PROGRESSIVE WAVES IN RIVERS.*

By VAUGHAN CORNISH, D.Sc., F.G.S., F.C.S., F.R.G.S., M.J.S., Associate of the Owens College, Manchester.

On "Roll-waves," or Down-stream Bores.

When the upper reaches of a river are swollen by rains, room is made for the flood by the gravitational rise of the water further down-stream. As in deep rivers the rate of propagation of a long wave is many times greater than the velocity of flow, the effect of this wave-transmission is to diminish the initial inequality of slope caused by the rain-water, and no wave is *visible*. The fact that in the lower reaches the level of the river rises before the arrival of turbid waters, alone attests the fact that flood-water has caused a progressive wave.

In certain rivers, however, of small depth (therefore propagating a wave slowly) and subject to sudden accessions from swollen tributaries, the "first rise" of water in the lower reaches frequently takes the form of a steep-fronted wave, or bore, travelling down-stream. On the Tees the phenomenon is called a roll-wave. Mr. F. R. Glyn, F.R.G.S., from whom I first received an account of the phenomenon, describes it as 2 or 3 feet high, reaching from bank to bank. He observed it on no less than six occasions during the course of one summer and autumn. It is a source of considerable danger to anglers, coming as it does wholly without warning and travelling at a considerable speed, viz. the speed

* Illustrated by photographs taken by the author.

of the stream *plus* the speed of a long wave in water of the actual depth.

A similar wave is known at Aysgarth on the Ure, which has also been described to me by an eye-witness as "2 or 3 feet high." The character of the channels of the rivers Tees and Ure is somewhat similar. At Aysgarth there are alternately pools and shoals, and the wave would of course mount up and appear more like a single wall of water in passing over the latter. The cross-section is very different to that of a river flowing through alluvium, the channels being carved in solid rock, and the depth of water at the sides being almost the same as in the centre.

On the Swale, the roll-wave just above Richmond (Yorks.) has been described to me by an eye-witness as apparently about 4 feet high. The upper portion of the Tyne is also subject to these waves. Roll-waves are said to be known also on the river Wye as a sequel of rains in the upper reaches, and in the rivers among the foothills of the Himalayas they are not uncommon.

The production of a roll-wave by a landslip has been occasionally observed. A notable case was that in which a big slip of mountain-side into Lake Chusenzi sent a roll-wave down the Nikko torrent, wrecking the celebrated "Thousand Buddhas," of which I had a description from the owner of a tea-house on the banks, who narrowly escaped the advancing wave.

It may fairly be asked, if floods cause down-stream waves, may not the ordinary inequalities of motion, *e.g.* those due to the formation and disengagement of eddies, also produce them? If so, down-stream waves must always be present in rivers. I find that in rapid streams their presence is revealed by the waves which come in where there is a shore shelving like a beach, as is sometimes the case on the inner side of a bend. Steep-fronted waves roll in there and break upon the shingle, their direction where they first become visible being diagonally down- and across-stream. Thence they swing round to face the shore, turning on the shallow end as pivot, in the manner of the breakers on the sea-shore. From this it follows that in the deep water of mid-stream these waves are also present, travelling down-stream, but invisible on account of their flatness.

Water flowing in a thin film inevitably does so in a series of miniature roll-waves or roll-ripples. This may be seen, for instance, on the sloping marble slab on which fish are laid in the front of a fish-monger's shop. Where a film of water slides down the rocks on steep mountain-sides it frequently is seen to take on the appearance of a series of progressive wavelets, but when the water follows, as is usual, a narrow channel, these wavelets have small lateral extension, and their

front assumes a V-shape, the wave being retarded at the edges of the channel where the water is shallower.

In a film of water these wavelets cannot grow, for the increase of depth at crest being accompanied by diminution at trough, growth would immediately be arrested by complete drying up at the troughs.

Beside the funicular railway from Territet to Glion (Switzerland), in a conduit 12 inches wide, with a uniform floor of cement (and vertical sides of the same material) with an average slope of 1 in 2, the water may commonly be seen to flow as a series of roll-waves which, commencing as confused ripples near the footbridge, grow in the space of a few yards to a uniform wave-length of about 2 feet, the depth at trough being, on one occasion, ascertained to be 0·1 inch, and at the crest 0·2 inch. When a large amount of water was turned into the conduit the roll-waves ceased, ordinary diagonal standing waves replacing them. When the excess of water ran off and the depth was again reduced to less than an inch, the stream began once more to flow gushingly as a series of roll-waves.

The explanation I offer is as follows: The velocity of flow is small when the water is very shallow, owing to friction against the bed. The slightest excess of retardation at any point momentarily increases the depth there. But the mere fact of increasing the depth increases the velocity, at any rate in the upper layer. Continuous motion is therefore impossible for very shallow water on a steep slope, and is necessarily replaced by gushing flow. If the bed be of uniform cross-section, the gushes take the form of regular transverse progressive waves. If, on the other hand, the channel be irregular, there may be no lateral co-ordination, and the intermittance of flow is only noticeable in the rushing sound, or in the beating action of the water against an immersed body.

At Merligen, on the Lake of Thun, is an open conduit 15 feet wide, 7 feet deep, 1360 feet long, and having a slope of about 1 in 14. The ordinary flow of the Grünnbach torrent, which is conveyed to the lake in this conduit, supplies a depth of from 1 to 3 inches at the entrance of the paved channel, the great depth of the conduit being designed for the accommodation of sudden floods. The floor of this conduit is paved with flat slabs of stone of rectangular form, with open junctions which are respectively parallel and at right angles to the flow of the stream. The transverse junctions form a series of inequalities across which the shallow stream flows. At the entrance of the paved channel the shallow water flows with a flickering appearance, caused by numerous steep-fronted progressive waves of minute amplitude and small lateral extension following one another at intervals of some inches, and passing the observer on the bank in a succession too rapid to admit of exact counting, but about 120 per minute. The regularization and growth of the waves takes place rapidly. Thus on June 6, 1904, although at

465 feet from the entrance, there was still some confusion from the presence of minor waves along with the larger ones, yet at 567 feet from the entrance the stream was flowing as a single series of roll-waves extending quite across the channel, passing the observer 33 per minute. At 1121 feet from the entrance the number passing was twenty, the height and length having increased in inverse proportion, and at the outflow, 1361 feet from the entrance, seventeen waves passed per minute. The mouth of the conduit is several feet above the lake, and the roll-waves impart to the waterfall a regular cadence (Fig. 1). This slow pulsation is often visible to the naked eye at a distance of 2 miles. Most of the observations were made when the uniform depth of water at the entrance of the conduit was about 1 or 1½ inch. The greatest observed depth there was 3 to 3½ inches, which was converted at the end of the flow to a succession of progressive waves about 6·5 inches in amplitude, the depth at trough being reduced to about 1·5 inch, and that at the crests increased to 8 inches. The wave-length near the exit was 66 feet. The time of flow of the water from entrance to exit was only 90·2 seconds, and the time of transit of the wave was less, so that the growth which occurs may well excite surprise. Measurements taken on several days indicate that the true velocity of the roll-wave is that calculated for a long wave.

Date.	Depth at crest. Inches.	Depth at trough.	Observed speed. f.p.s.	Calculated speed. f.p.s.
August 26, 1904	2·5	1	2·06	2·58
September 8, 1904 ...	4·0	1	3·275	3·27
June 15, 1905	4·5	2	3·54	3·47
September 16, 1904 ...	8·0	1·5	3·00 *	4·60

In the Grünnbach conduit it is apparent to the eye that the growth of the roll-waves is partly due to the fairly regular transverse inequalities, so that we have in this case a cause additional to that of friction, with a uniform, but not perfectly smooth, bed. In deeper water transverse inequalities produce *stationary* transverse ridges of water, the familiar standing or stationary waves. Close observation enabled me to detect in some shallow conduits the co-existence of stationary and progressive waves, the former caused wholly, the latter partly by transverse ridges on the bottom. This was particularly well seen on a short, steep conduit at Ralligen, between Merligen and Gunten. The relative conspicuousness of the two kinds of waves depended to a considerable extent upon the mode of observation.

* The observed speed of *current* this day was probably too great, for the foaming waves whirled along the floating matter. Hence the wave-speed comes out too low.

FIG. 1.—ROLL-WAVES IN THE GRÜNNBACH CONDUIT.

FIG. 2.—ROLL-WAVE LEAPING THE OUTFALL OF THE GRÜNNBACH CONDUIT.

When regarded with a steady, wide-eyed gaze, the fixed waves were clearly seen (as is usual), and only a very slight and irregular flicker was noticeable in the moving water. But when the eyes were more than half-closed, so that the outline of the fixed objects became blurred, the passage of transverse roll-waves could be very distinctly seen. The discovery of this device I have found to be of great assistance in studying waves in running water. One of the reasons why they are so little known is that the eye is usually dominated by objects which are stationary relatively to the bank.

At Gunten, also on the lake of Thun, is another conduit, comparable in size to that at Merligen, but with a rougher pavement, and sloping instead of vertical sides. It has a gradient of about 1 in 22. The waterfall by which this conduit discharges into the lake has usually a regular cadence, due to the succession of well-defined roll-waves, which can be seen in the lower part of the channel. Their production, however, takes place in a different manner from that observed in the Grünnbach conduit. Indeed, for the greater part of the course no roll-waves are formed, and their formation is *sudden*. At or near some position, which varies somewhat from day to day, a sound like that of the word "flop" is heard from time to time, and on looking in the direction of the noise the roll-wave (perhaps half an inch in amplitude) is seen to be already formed, and it grows rapidly as it rolls on. The cause appears to be that there are long shallow "pools" in the channel difficult to distinguish on account of the roughness of the pavement. It is at the lower lip or sill of one of these that the infinitesimal down-stream waves, which are always present in a stream, particularly a rapid one, congregate and swell until they burst over the obstruction in the form of a bore. The preparation for this is generally a slight failure of the current, reducing the depth on the sill.*

Another paved conduit where the roll-waves arose in the same way was found near St. Maurice, in the Rhone valley. Longitudinal inequalities of depth greatly hinder the formation of roll-waves, and even destroy them after they have definitely formed. This was seen in the St. Maurice conduit, which terminated, not in a waterfall, but in a winding channel between sandy shores. Here the wave-front immediately *lost its transversality*, and the wave was no more seen. The circumstances that both current and wave are more rapid where the depth is greater, and that current and wave are travelling in the same direction, combine to rapidly destroy the transversality of the wave-front. It is less visible when not transversal, and also soon destroys itself by running upon the shelving shores. Vertical walls (as in the Grünnbach conduit) do much to preserve the roll-waves. In the case

* After thunderstorms, with a depth of 4 to 6 inches, no roll-wave was formed.

of tidal bores, where current and wave are opposite in direction, there is no such co-operation to destroy the transversality, and this is one reason for the superior stability of bores which travel up-stream.

The break-up of a high waterfall into conical masses was described by Livingstone,* who compares them to "small cômets." They have also been called "water-rockets." Their formation marks an intermediate stage in the process which finally dissipates the water in spray, a process due to the dynamic instability of a sheet of water falling under the acceleration of gravity. In most waterfalls the "comets," or "rockets," though visible, are not conspicuous, but in some, as for instance those of the Tschingelbach, at Burglauenen, in the Lutschenthall (Switzerland), when the amount of water is suitable, the regular procession of falling cones is the chief beauty of the fall.

In this instance the water, before its leap, slides in a shallow sheet over a slab of steeply sloping rock, where it goes into fairly regular roll-waves, and this is the cause of the development of the cone structure from a subordinate to a principal feature of the fall.

On Tidal Bores as observed in the River Severn.

This paper deals only with visible waves, and the tide-wave in rivers in its ordinary form is therefore outside our purview. In some rivers, having large tides and sandy estuaries, the "first rise" of the tide takes the form of a visible steep-fronted wave, or waves. These the author has observed at various times and places on the river Severn,† and in the present paper, omitting mere description as much as possible on account of considerations of space, some account is given of these observations as far as they tend to advance our knowledge of the *character* of this class of wave, of the conditions which determine its *place of origin* in an estuary, and of the causes which produce the apparently capricious *variations* of its magnitude.

The Severn bore is seen between Gloucester and Severn Bridge. The places where it approaches with the appearance of a wall of foaming water are the shallows. In the deep pools it generally takes the form of rounded swells, which rapidly multiply in number; and there it often ceases to be visible, reappearing afterwards when it comes to shallow water. It seems, therefore, that an error is made in regarding the bore as the steepened front of the whole tide-wave, for on that supposition it would be "long" as compared with the depth of the pools, and would even there be a steep-fronted and solitary wave. The rise of a tide is never a steady process, as is shown by the

* 'Missionary Travels and Research in South Africa,' description of Victoria Falls.

† See *Nature*, June 7, 1900, and *Geogr. Journ.*, January, 1902, "On Cinematographing the Severn Bore."

"notches" in the curve of tide-gauges, and as may be seen in the way the incoming tide (*e.g.* at Montrose, N.B.) bursts over sands and then recedes before finally covering them. In the windings of an estuarine channel the rise of the tide would be specially subject to such pulsations, and it appears likely that the bore is the front of such a partial swelling, and the sudden overcoming of obstruction. The preceding remarks on roll-waves illustrate this view.

The Severn bore originates where the low-water gradient of the estuary is *steep*, which is between Hook Cliff and (about) Shepherdine Sands. It occasionally starts below the Severn Bridge, which is between these places, but vanishes again, the true start being only made between Severn Bridge and Hock Cliff. It is not difficult to understand why the bore should start where the gradient is steep (with shallow water and an opposing current to cause obstruction and local swelling), but observation on the spot was needed to show why it originates in the upper instead of the lower half of the steep slope of the river. I find the cause to be a matter of alternative low-water channels. In the lower part of the "Steep slope" from Hock to Shepherdine the "first of the flood," meeting the ebb in the main channel, fills up a swatch-way or side channel, and then overflows the intervening sandbank, entering the ebb channel laterally. There ensues a circulation of waters instead of a wave. Higher up there is, as a rule, no alternative channel, and the ebbing current stems the rising tide until a sufficient "head" accumulates, and a visible wave moves slowly up the shallow channel with a foaming front.

In this part of the river, however (between Awre on the right bank and Frampton on the left), the low-water channels vary considerably, according to the wetness or dryness of the season, much land-water cutting a deep and strongly curved trench on the Frampton side, whereas, when there is little land-water, the flood-tide has more effect in determining the low-water channel, which is then straighter,* and nearer to the Awre side. In the latter case (as I observed well on October 30, 1901), the tide reaches Hock Cliff with a considerable bore, but the water then turns and flows *down* the empty Frampton channel. The bore subsides, and, after a large area has been covered or filled, the tide advances quietly towards Newnham, where, on this occasion, the bore was small, although the total rise of tide was great.

The very existence of a bore in a riverine estuary is the sign that a stable *régime* has not yet been attained in the part where the bore originates. Below Severn Bridge, the ebb and flood respectively have so adjusted the sandbanks that the bore is for the most part avoided. Between Severn Bridge and Hock Cliff that adjustment is not yet

* See the author's paper in *Geogr. Journ.*, August, 1901, on "Sand-waves in Tidal Currents."

affected. Towards the end of each set of "spring" tides it is more nearly effected than at the beginning, for (as Mr. D. Wintle, of Newnham-on-Severn, has pointed out to me) the bore is less on the later days. It is, in fact, the flood tide which makes the alternative channel whereby the bore is avoided.

In Prof. Osborne Reynold's experiments with model estuaries,* bores were sometimes formed in the earlier stages before the sandbanks had attained their final shapes.

On Cross-stream Progressive Waves.

There remains yet another variety of progressive waves in rivers, which is generated from the familiar stationary or standing waves.

By introducing an obstruction in a stream, it is easy to see the process of formation of a group of standing or stationary waves (Fig. 3). The formation of the first wave is instantaneous, and the production of the other waves to leeward occupies a very short time. Thereafter the waves are fixed in position, size, and form, as long as the current is constant. In actual rivers, however, slight variations of current are going on all the time, and the standing waves fluctuate slightly about their mean position, the range of their excursion being usually, however, less than the length of the visible mound of water. Accompanying this slight fluctuation of position is a corresponding change of shape, which sometimes causes an intermittent breaking (upstream) of the steepest member of the group.

In the Whirlpool Rapids of Niagara river (in which locality I spent three weeks for observations on waves in 1903) the standing waves are of great size, in some cases attaining a total height of 15 to 20 feet; and, the river being narrow, there is a superposition of waves, the stationary waves extending in diagonal ridges from the opposite banks to, and beyond, the middle of the stream. The fluctuation of the standing waves is much greater than in quieter and less rapid rivers. A wave will slowly wax to a maximum (say 12 feet), and then, more suddenly, drop to its minimum height (say 10 feet), and in doing so it disengages a visible progressive wave, of which the steep and foaming front faces diagonally up-stream, in the same direction as the parent wave. As we follow the disengaged progressive wave in its course, we see, although the foaming crest faces somewhat up-stream, as well as across, that the whole *drifts* down-stream, so that the resulting motion relatively to the bank is across-and-down-stream, at an acute angle with the direction of the current. At the centre of the river, where cross the ridges of the standing waves, are those great, steep, and foam-capped mounds of water which are the most striking individual wave-forms of

* Reports, British Association, 1890 and 1891.

FIG. 3.—STATIONARY WAVES ON THE RIVER AARE.

FIG. 4.—LEAPING WAVE, WHIRLPOOL RAPIDS, NIAGARA.

the rapids. Upon these, at irregular intervals, converge several of the cross-stream progressive waves, and then occurs that sudden leap and shattering of the great water-mound, which constitutes the Leaping Wave, which is the climax of all the tumults of Niagara. The great "leaps" take place always at the same spots, namely, where the standing ridges cross. The development of cross-stream progressive waves as a secondary phenomenon of standing waves is much greater where there is a superposition of two sets of waves, because wave motion is essentially differential, and the fluctuation of a "waved-wave" (as I may term it) is in a high degree more sharp and sudden than that of a simple wave. This fact I confirmed by observation on several of the St. Lawrence rapids.

Those who wish to understand these phenomena must carefully guard against the logical error of attributing the cross-stream progressive waves *directly* to the effect of resistances upon the current, the primary and principal effect of which is the production of *stationary* waves.

When standing on the bank of the Whirlpool Rapids, surges rush in, which cause alterations in the level of the water of 2 feet or more. In what proportion these are due to the above-described cross-stream progressive waves, and in what proportion down-stream progressive waves may contribute, I am unable, at present, to say.

DR. STEIN'S EXPEDITION IN CENTRAL ASIA.*

FROM Kashgar, where, with the valuable help of Mr. Macartney, the Indian Government's representative, I had succeeded in organizing my caravan within a fortnight of my arrival, I commenced my journey south-eastwards by the end of June. The intense summer heat of the Turkestan plains precluded all thought for the next two months of archæological exploration in the desert. For the journey to Khotan, the intended starting-point of my archæological labours, only two weeks' marching was needed, and I was thus free to utilize the rest of the interval for geographical and anthropological work in the westernmost Kuen-lun range.

While I myself was busy at Kashgar, Rai Ram Singh had under my instructions carried a systematic survey by plane-table and theodolite through a still unexplored section of the Tashkurghan river valley, and thence along the eastern slopes of the Mustagh-ata range to the latitude of Yangi-Hisar. After he had joined me at Yarkand, we marched by a

* Communication from Dr. M. A. Stein, dated Keriza (Kiria), October 10, 1906.

hitherto unsurveyed route east of the Tiznaf river to the outer hills about Kokyar. There I was able to collect a considerable mass of anthropological measurements and data about the people of Pakhpo, an interesting small tribe preserving in its alpine isolation all the main characteristics of that race, closely allied to the present Galchas of the Pamirs and of Iranian speech, which in ancient times must have extended further east as far as Khotan. From Kokyar I marched through the outer hills to Khotan, surveying in detail the little-known route which crosses the debouchures of the Kilian, Sanju, and Duwa valleys.

While engaged myself about Kokyar, I had despatched Surveyor Ram Singh to map the snowy range about the Karlik Dawan, never fully surveyed, and subsequently to push on to the upper Kara-kash, from where access might be gained to the last bit of *terra incognita* remaining in the difficult mountain region between the Kara-kash and Yurung-kash rivers. He effected this task with complete success. He reached the Kara-kash in spite of serious risks from the floods filling the narrow gorges, and thence managed to cross the main range by the Hindu-tash pass, which several European travellers had attempted in vain, and which had become practically unknown even to the local Kirghiz. A great and much crevassed glacier to the north of the pass was the chief obstacle. The great valley of Pusha, to which this pass gave access, proved to possess extensive grazing-grounds with an abundance of vegetation quite exceptional in those barren mountains. Descending from Pusha towards Khotan, Rai Ram Singh crossed in succession other deep-cut valleys draining into the Karakash, and finally connected his work with our surveys of 1900 about the Karanghu-tagh mountains.

After my arrival in Khotan early in August I was busy for some days collecting antiques brought by local "treasure-seekers," and setting on foot the inquiries which were to guide me thereafter to ancient sites capable of excavation. Then I started with Ram Singh for the high mountains south of Khotan, in order to supplement the surveys made in 1900 by ampler topographical details about the great glaciers which feed the headwaters of the Khotan river. The conditions proved very difficult owing to the streams swollen by the summer floods and the plentiful rain and snow encountered at higher elevations. The difficulty of obtaining transport and guidance from the few scattered settlements of herdsmen was also great. Yet we managed to push our surveys up the imposing glaciers of the Nissa valley, and the equally big ones crowning the watershed above Karanghu-tagh. Numerous photographs were secured, and many details cleared up in the necessarily distant photo-theodolite panoramas which more favourable weather conditions had enabled me to take in the autumn of 1900, and which the Royal Geographical Society will publish.

Less than a week after my return to Khotan from my expedition in

the mountains, I started for my archæological campaign in the desert eastward. My first surveys were directed to various ancient remains reported between the great Stupa of Rawak, partly excavated by me in 1900, and the extensive *débris*-strewn areas known collectively as the Tati of Hanguya. I found the court of the Rawak Stupa even more deeply buried under dunes than before, but succeeded in tracing in its vicinity other indications of early occupation. The excavation of a ruined temple on the Hanguya Tati yielded many interesting small terra-cotta relievos which once decorated its walls. The style of these sculptures is plainly derived from models of Græco-Buddhist art, and agrees closely with that of the Rawak Stupa relievos dating approximately from the fifth to the sixth century A.D. A specially interesting feature of the sculptural remains recovered is the prevalence of richly gilt pieces. This strikingly confirms the hypothetical explanation I had given of the origin of the leaf-gold washed from the culture strata of the old Khotan capital at Yotkan.

The site appears to have continued under occupation for some time after the temple became a ruin, and this accounts for only remains of such hardness as terra-cotta surviving in a soil kept moist by irrigation. The ruin lies only about 2 miles from the present edge of the irrigated area, and cultivation in the fertile Hanguya tract is now steadily advancing in the direction of the areas previously abandoned to the desert. There is plenty of water available for extended irrigation in the canals fed by the Yurung-kash, and if the present favourable economical conditions and the increase of the population continue, it seems quite possible that much of this desolate Tati, overrun by dunes in parts and elsewhere undergoing wind-erosion, will be recovered from the desert within no distant period.

Throughout the portions of the Khotan oasis revisited, I was struck by the considerable extension of cultivated ground which has taken place even during the last six years only. Large areas which lay waste or were actually covered by drift sand in 1900–1901 have since been brought again under cultivation, *e.g.* at the ancient site of Chalma-kazan. The great advance in prosperity which is now taking place throughout the western oases of Chinese Turkestan seems to have in Khotan a specially marked effect on the cultivated area and the number of the population occupying it. The power of rapid recuperation thus illustrated has its antiquarian as well as its geographical interest, and deserves to be kept in view when considering questions about earlier physical conditions in historical times. What systematic irrigation works on a large scale might do for the Khotan oasis would be an interesting subject of investigation for a competent irrigation engineer, preferably of Indian experience, for much in the mode of cultivation curiously recalls those prevailing in the Punjab and on the Indian North-West Frontier.

East of the Khotan oasis, a group of small ruined sites in the scrub-covered desert not far from the village tract of Domoko was my first objective. I had passed in 1901 the northernmost of these sites, showing the eroded remains of some dwellings. But information about the rest had become available only since, a few years ago, an enterprising villager had commenced to seek there for "old papers" to sell in the antique market of Khotan. Securing this man's guidance, I proceeded to the site of Khadalik, which had furnished manuscript finds of interest. Its principal ruin proved a Buddhist shrine, which had been reduced by the operations of "treasure-seekers," etc., already in early times, to the condition of a large *débris* heap. Fortunately, the recent burrowings had only scraped the mound, and by systematically clearing the remains of the original structure, I was able to recover a large number of manuscripts on paper, in Sanskrit, Chinese, and in the "unknown" language of old Khotan, besides many wooden tablets inscribed in the same language and some in Tibetan. The great majority of the manuscripts contain portions of Buddhistic text, which had been deposited as votive offerings. The plentiful remains of stucco relievos, of frescoes once adorning the temple walls, and of painted panels, proved of considerable artistic interest. Their style alone would have sufficed to make it highly probable that the shrine belonged to the same time as the temples excavated by me at Dandan-Uilik, *i.e.* to the latter portion of the eighth century A.D. But the subsequent discovery in a second shrine close by of stringed rolls of Chinese copper money, manifestly deposited by some of the last worshippers, supplied definite numismatic proof of the same dating. The same temple, besides other interesting relics, furnished also portions of a far older Sanskrit manuscript on birch-bark, no doubt imported from India. Some excellently preserved large rolls of a Buddhistic text in Chinese, having on the reverse what evidently is its translation into the "unknown" language of old Khotan, may prove to furnish the long-desired clue for the decipherment of the latter.

Notwithstanding an adequate supply of labourers and almost continuous exertions, the excavation of these temples and of smaller adjoining shrines kept me at work here for ten days. The examination of the neighbouring small sites revealed only remains of dwellings too far exposed by erosion to retain much of antiquarian value. But even here distinct proofs were forthcoming of their having been deserted, just like Dandan-Uilik and Khadalik, about the end of the eighth century. This chronological fact has also a geographical interest. Khadalik is separated by only 3 miles from the stream which irrigates the northernmost portion of Domoko; while Dandan-Uilik, which, as duly recognized also by Mr. Huntington, who carefully studied the physiography of this region a year ago, once received its water from the same drainage system, lies fully 56 miles further north in the desert. It remains to be seen

how far the fact of such widely separated localities having been deserted at the identical period can be adequately accounted for by purely physical changes.

In this connection the results obtained by the excavation of an ancient rubbish mound near the southern edge of the Domoko oasis, *i.e.* on the side away from the desert, may also claim a special interest. These excavations yielded, besides documents in the Brahmi script of old Khotan, a large collection of Chinese records on wood of an administrative character. The rubbish deposits of this locality date also approximately from the close of the eighth century, and it is just at that period that Chinese dominion in Eastern Turkestan, and with it a period of prosperity, was brought to an end by Tibetan invasion. During these archæological labours, Surveyor Ram Singh has been triangulating the high snowy range about the headwaters of the Keriya and Niya rivers. After completing my Domoko excavations, I proceeded to Keriya, from where I am now starting for my nearest goal eastwards—the ancient site in the desert beyond Niya.

THE INCLOSURE OF COMMON FIELDS CONSIDERED GEOGRAPHICALLY.

By Dr. GILBERT SLATER.

THE idea which the word "inclosure" ordinarily suggests is inclosure of a common; in legal phrase, of the "waste land of a manor." By such inclosure rights of common of pasture or fuel are abolished over a tract of land which is parcelled out among various persons who lay claim to it, in order that it may be better cultivated or otherwise more fully utilized.

The inclosure which is our subject—the Inclosure of Common Fields—is from the legal point of view similar, but from an industrial and sociological point of view, widely different. We may call it "the extinction of village communities," or "throwing parishes into the melting-pot." These phrases imply that in places where *common fields*, as distinct from *commons*, are inclosed, (1) there was, before inclosure, a definite survival from ancient times of the village community; (2) that such inclosure was a village revolution, a crisis in the village history, from which the village emerged with its social constitution materially altered.

A Concrete Example: Castor and Ailesworth.—A definite concrete instance will make the general idea clearer. A good recent example of common field inclosure is that of Castor and Ailesworth, two hamlets forming part of one parish, a few miles from Peterborough. In 1892, when application was made for an Inclosure Act to the Board of Agriculture, Castor and Ailesworth were an excellent example of the open-field or common-field parish of the Midlands. All the houses, except the mill and the railway-station, were clustered together near the church and along the high-road. Just behind the houses were a number of old closes, chiefly used as paddocks; beyond, northwards and southwards, stretched the open

D 2

common arable fields, innocent of fence or hedge, except that here and there an old *mere* or *balk* had escaped the plough, and become the habitat of trees and bushes, and so acquired the appearance of an imperfect hedge. The tithe map and award of *Castor and Ailesworth before Inclosure* show how the twenty odd different properties were intermingled in these arable fields in extraordinary confusion. To the rector, for example, there belonged 100 acres in these arable fields as part of his glebe; and these 100 acres were made up of 145 separate strips of land, each with no better boundary from other properties on each side than a mere furrow. In the midst of these arable fields were various stretches of common pasture. In the north-west corner was, and is, Ailesworth heath, a bit of rough common of the familiar type. To the south, along the river Nen, were the open common meadows, in which properties were just as much intermingled, and, in fact, divided into even smaller strips than in the arable fields.

A map showing the different farms would present the patchwork appearance in a greatly enhanced degree. The man pointed out to me as the chief farmer in Ailesworth, told me he held, before inclosure, 175 acres of land in 192 different parcels. The farms were small. Each consisted of a number of little strips of land, averaging rather less than an acre each, in the arable fields, and all subject to common rights; of a number of smaller strips of land in the meadows, these again subject to common rights; and, further, of certain rights of common, exercisable over arable, meadow, common pasture, and (if in Ailesworth) the Heath. But a farm was limited in its extent to Castor *or* Ailesworth.

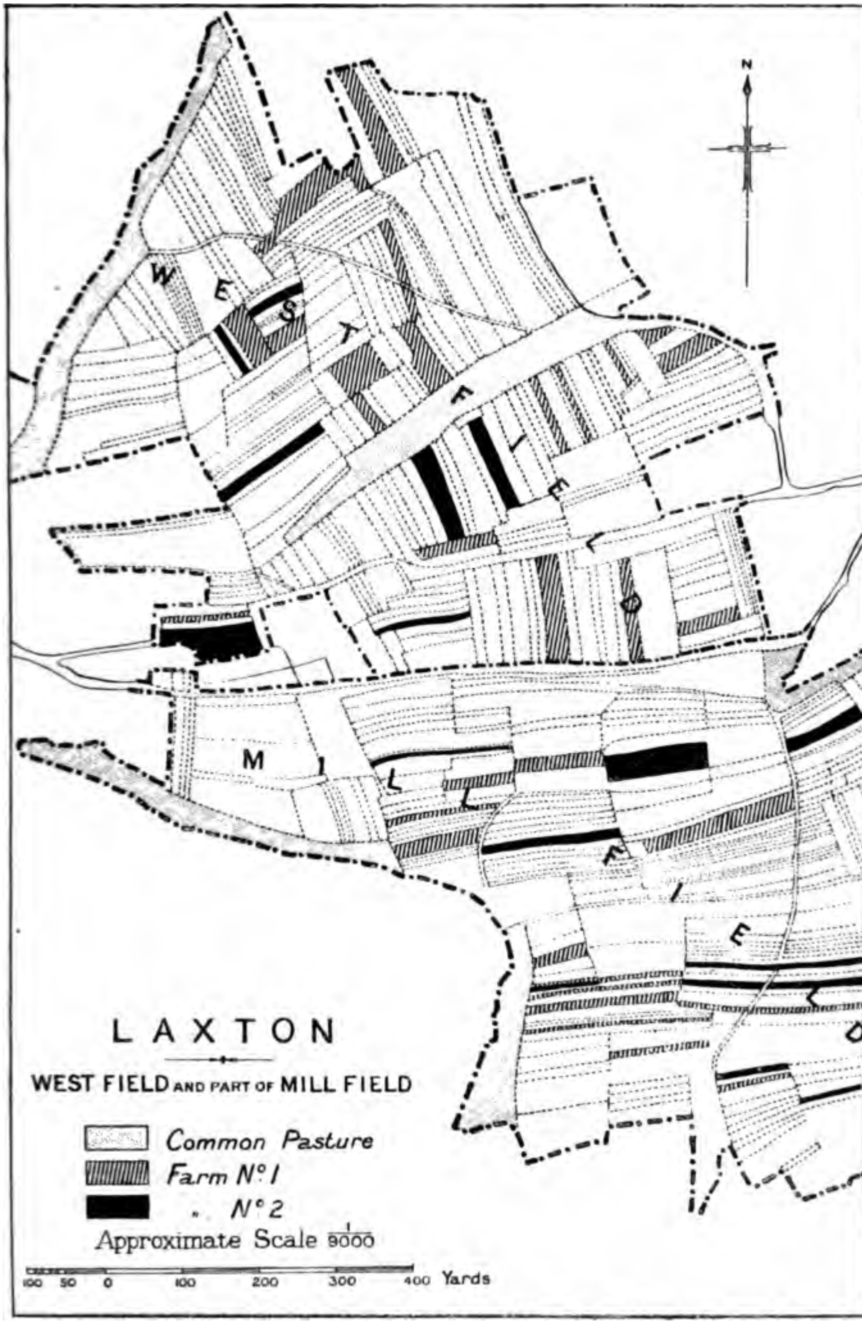
The accompanying map of part of Laxton parish, which is still uninclosed, illustrates this intermixture of farms.

The hamlet was the unit of cultivation, not the farm. The farmer did not farm as he chose, but according to the method prescribed for him, by common agreement guided by custom. The custom of cultivation was the three-field system. The arable land of each hamlet was divided into three fields, sown in rotation with (1) wheat, (2) barley, (3) what was locally termed the "follow crop," which might be peas, beans, tares, turnips, or other roots.

In the spring the farmers and toft-holders, *i.e.* the villagers who enjoyed common rights in respect of their cottages, met to determine certain questions. One farmer kept the "stint-book," which recorded the number of "stints" held by each person. The "stint" was the unit by which rights of common were measured, one stint being the right to pasture, during a defined part of the year, one horse, or two cows, or ten sheep. The meadows were commonable from August 12 to February 14, the wheat-field and barley-field from harvest-time to sowing-time, but as to the third arable field, a vote was taken as to what crop should be raised, and when it should be thrown open to be pastured in common. There was a tradition that if the farmers were not agreed upon some one crop, this third field was commonable all through the year, and that any individual farmer who sowed or planted did so at the risk of having his produce eaten by his neighbours' cattle.

When inclosure was effected each separate strip of land in field and meadow had to be measured and valued, each common right also to be valued, and the whole area of the two hamlets redivided among the several proprietors. The proprietors were required to adequately fence their properties; and they redivided them among their tenants, so as to give to each tenant a compact holding, which he might cultivate as he chose, within the limits of his tenancy agreement.

To sum up, the inclosure of common fields abolishes, where it takes place—(1) The intermingling of properties; (2) the intermingling of farms; (3) a certain measure of collective use and administration of the lands of a village by the



N
WEST FIELD
MILL FIELD
LAXTON
WEST FIELD AND PART OF MILL FIELD
Common Pasture
Farm N° 1
" N° 2
Approximate Scale 1/8000
100 50 0 100 200 300 400 Yards

villagers which had survived up to the time of inclosure. It will be seen that the term "extinction of a village community" is not a misnomer for such inclosure as that of Castor and Ailesworth.

Distribution of Recently Surviving Common Fields.—A statistical and geographical summarizing of Acts of Inclosure for Common Fields, such as I have attempted, involved a preliminary difficulty. In all published indexes and summaries no distinction is made between Acts for bringing a piece of commonable waste into several ownership and cultivation, and Acts for effecting such village revolutions as was effected in Caster and Ailesworth. It was therefore necessary for me to begin *de novo*, to read the Acts themselves, and to ascertain, usually from the preamble, to which class each Act belonged. Then one finds that, though the great majority of Acts are clearly and definitely of one of the above two classes, there are yet to be found all manner of intermediate connecting links. There are, for example, Acts for inclosing commonable meadows, and Acts for inclosing a great stretch of moor, together with a little remnant of common field arable. A hard-and-fast line had to be drawn somewhere, and I have made the mention of arable common field the test, including in one class all Inclosure Acts by which any such land was inclosed.

Having compiled my list of these Acts, I sorted them out into counties, and then discovered some striking facts. I found that whereas the inclosure of waste by Act of Parliament took place during the eighteenth and nineteenth centuries, over all the counties of England and Wales, the inclosure of common fields showed a peculiar and striking geographical distribution. Making allowance for the area covered by Acts which did not state the area inclosed, I found the total area covered by Acts for inclosing common fields in each county, and the percentage that area was of the total area of the county. Here are the percentages in order of magnitude:—

Northampton ...	... 51·5	Wiltshire ...	... 24·1	Essex	... 2·2
Huntingdon ...	... 46·5	Gloucester ...	... 22·5	Sussex ...	... 1·9
Rutland ...	... 46·5	Middlesex ...	... 19·7	Northumberland	... 1·7
Bedford ...	... 46·0	Worcester ...	... 16·5	Cumberland ...	... 1·7
Oxford ...	... 45·6	Derby	... 15·9	Durham ...	... 0·7
Yorks., East Riding	... 40·1	Herts	... 13·1	Westmoreland	... 0·6
Leicester ...	... 38·2	Yorks., West Riding	... 11·6	Cheshire ...	... 0·5
Cambridge ...	... 36·3	Dorset	... 8·7	Monmouth ...	... 0·4
Bucks. ...	... 34·2	Suffolk ...	... 7 5	Shropshire ...	... 0·3
Notts.	... 32·5	Surrey	... 6·4	Kent	} ... ... 0·0
Norfolk ...	... 32·3	Yorks., North Riding	6·3	Lancashire	
Lincoln ...	... 29·3	Hereford ...	... 3·6	Devon	
Berkshire ...	... 26·0	Somerset ...	... 3·5	Cornwall	
Warwick ...	... 25·0	Stafford ...	... 2·8		

These results were sufficiently remarkable to whet one's curiosity. I accordingly determined to investigate further, obtained a series of Ordnance Survey county diagrams, which show the division of each county into parishes, and coloured the parishes inclosed by Act of Parliament. Parishes inclosed in the eighteenth century, up to the end of 1801, I coloured yellow. In 1801 a Clauses Act was passed, to diminish the Parliamentary expense of inclosure; parishes inclosed from that time up to the passing of the General Inclosure Act of 1845 I coloured green; parishes again inclosed under that Act I coloured purple. Finally, I copied the results obtained from each county map upon a map of England.

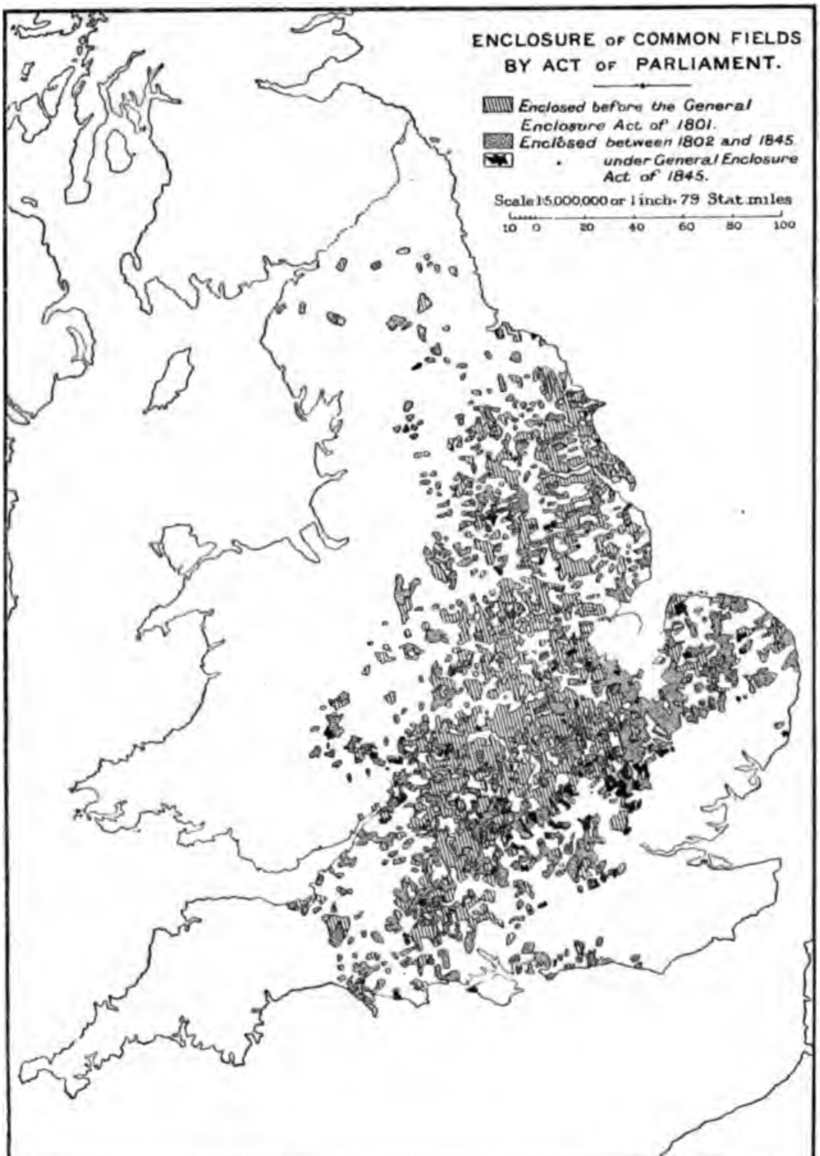
The result was surprising, though it takes some thinking to see how surprising it is. We find that what I may term the "belt of Parliamentary inclosure" stretches diagonally across England from Flamborough head towards the Solent, with a fringe of country that needed no such drastic steps to effect the extinction of village communities on either side. On the south-east we find a sharp line running through Suffolk, Essex, right through London, and along the summit of the North Downs, dividing the region of Parliamentary inclosure from the region of voluntary inclosure. We find a similar line on the south-west, nearly as sharp and well defined, passing through Somerset and Dorset. But to the west, north-west, and north there is instead a gradually increased scattering and rarity of the spots of colour indicating Parliamentary inclosure. Obviously, we have here a series of facts of geographical and historical significance. But what is the significance?

Co-aration.—Before we can address ourselves to this inquiry, certain general ideas must be clearly grasped. In the first place, the common-field system of agriculture, though it has far greater merit than might be supposed, is inconvenient and uneconomical; it is wasteful of the labour of men and horses; it offers certain important advantages to the labourer, but smaller profits to the farmer, and much smaller rents to the landlord, than the modern system, which used to be called "severalty." It is, therefore, plainly a survival, a degenerate form evolved from institutions and customs which in their day were convenient and economical. It is agreed that the intermingling of lands and the right of intercommon must have originated from the ancient practice of co-aration, of collective ploughing, which even at the present day has not completely died out in the British Isles. Domesday records how the villeins in such and such a manor had so many ploughs. Those ploughs were ordinarily drawn by eight oxen, and the ordinary villein possessed but one or two. The villeins yoked their oxen together to a common plough, and the common plough ploughed an acre or half an acre on Monday for this tenant, on Tuesday for that, and when it had served each, it began at the first again. If, therefore, any district was brought into cultivation after co-aration had disappeared in the neighbourhood, such a district would never need Parliamentary inclosure, because it would never pass through the common-field system of cultivation.

When did co-aration die out? We can trace its disappearance over Scotland. It died out in the Inner Hebrides about the year 1850; in Central Scotland in the middle, and in the Lowlands in the beginning, of the eighteenth century. We have no such definite information for England. I believe we can fix the period immediately after the Restoration—that is, the latter part of the seventeenth century—as the time when co-aration disappeared in Durham. Lincolnshire was the chief starting-point originally of the Pilgrim Fathers, and they, it appears, practised co-aration in New England, for a common-field system was re-created across the Atlantic. It does not follow that co-aration was practised in Lincolnshire when the founders of New England fled this country, but we may guess that it had existed recently enough to be remembered. On the other hand, the "Select Pleas in the Manorial Courts" show that individual ploughing was practised in Northamptonshire as early as the fourteenth century, because manorial tenants are repeatedly charged with ploughing edges of their neighbours' strips into their own land. Here, again, it may be remarked that individual ploughing by the wealthier tenants might begin a very long time before collective ploughing by the small men was abandoned.

Our knowledge, therefore, of the date of the dying out of co-aration from different parts of England is exceedingly vague. My own belief is that the process

of local extinction began in the south-east corner quite early in the fifteenth century, gradually spread northwards and westwards, finally reaching Cumberland as late as the eighteenth century.

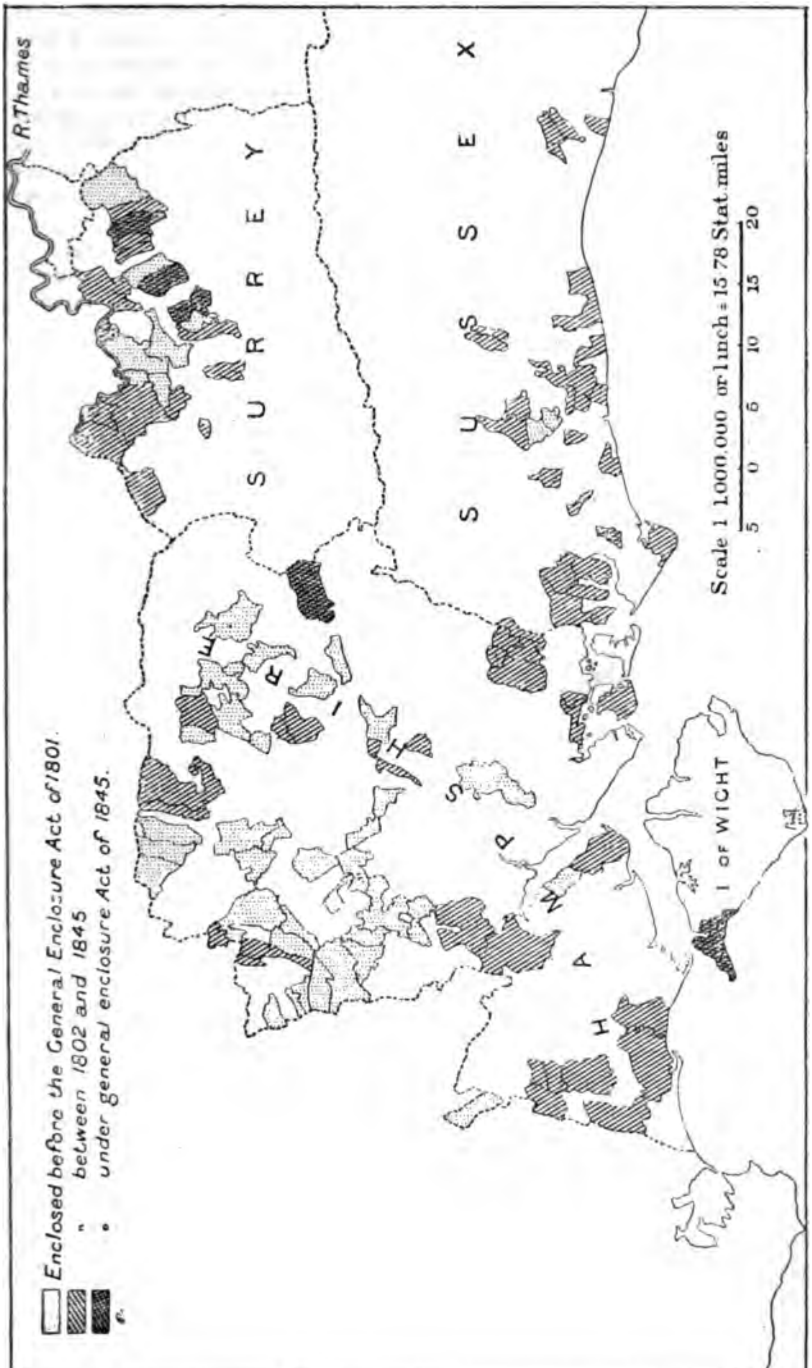


Mr. A. N. Palmer has reached the conclusion, from examination of old documents, that co-aration died out, except among the smallest holders, in the marches of North Wales, as early as the reign of Henry VI.

Looking now at the map, we find a white area in the neighbourhood of the


EAST MIDLANDS
SECTION I.
Enclosed before the General Enclosure Act of 1801.
" between 1802 and 1845.
" under general enclosure Act of 1845.
Scale 1: 1,000,000 or 1 inch = 15·78 Stat. miles.
5 0 5 10 15 20
RUTLAND
HUNTINGDON
BEDFORD
HERTFORD
R. Nene
R. Thames
ESSEX


EAST MIDLANDS
SECTION 2.
Enclosed before the General Enclosure Act of 1801.
" between 1802 and 1845
" under general enclosure Act of 1845.
Scale 1: 1.000,000 or 1 inch = 15·78 Stat miles.
5 0 5 10 15 20
N O R F O L K
R. Ouse
C A M B R I D G E
Little O
R. Waveney
S U F F O L K
R. Stour
E S S E X


Enclosed before the General Enclosure Act of 1801.
" between 1802 and 1845
" under general enclosure Act of 1845.
R. Thames
SURREY
SUSSEX
HAMPSHIRE
I OF WIGHT
Scale 1 1,000,000 or 1 inch = 15.78 Stat. miles
5 0 5 10 15 20

Wash, which we may, without hesitation, attribute to the late reclamation of the land. In Surrey, too, we notice that the common fields enclosed by Act of Parliament all lie on the north slope of the North Downs. The few common fields of Sussex known to have survived into the eighteenth century also all lie above the Chalk on the south side of the South Downs. In between is the Weald, which remained forest up to a comparatively late date. The patches of land in the Weald which were ever cultivated by co-aration were, no doubt, too small and scattered to persist as common field, and this sufficiently explains the fact that we have no Acts for inclosure of common field for the Weald.

Depopulation Acts.—The above solution of the problem, however, does not take us very far. In searching for broader explanations applicable to the country generally, we must be guided by one central fact. The shaded districts in my map are the districts in which common field persisted to the latest period. It was because the common-field system had persisted in these districts, in spite of all other hostile forces, that finally this costly, cumbrous machinery of special Acts of Parliament was fashioned in order to crush it piecemeal. Over all the south of England the unshaded districts escaped Acts of inclosure of common field, because their common fields had disappeared before Inclosure Acts began, *i.e.* before the eighteenth century.

The evidence of this fact is clear and convincing. We have Leland's Itinerary. Leland, King Henry VIII.'s antiquary, traversed a great part of the country in the years 1536 *et seq.*, and described the state of inclosure. We find the district within the belt of Parliamentary inclosure described by Leland as "Chaumpaine;" we find throughout the district which is free of Parliamentary inclosure the cultivated land described generally as "inclosed." "W.S.," in the celebrated tract, 'A Brief Conceipt of English Policy' (about 1550), mentions "those countries which be most inclosed, as essex, kent, devenshire." Carew, in his 'Survey of Cornwall,' 1602, describes all cultivated land in that county as inclosed, and says of the inhabitants, "They fal everywhere from Commons to Inclosure, and partake not of some Eastern tenants' envious dispositions, who will sooner prejudice their own present thrift, by continuing this *mingle-mangle*, than advance their lordes expectant benefit after their terme expired." Joseph Lee, in 'A Plea for regulated Inclosure' (1656), says, "Are not many places in England, Essex, Hereford, Devonshire, Shropshire, Worcester, wholly inclosed?"

The early inclosure of the south-east corner of England is precisely what one would naturally expect. The remarkable feature about it is the sharpness of the line bordering the early inclosed district. It has been observed that this line passes exactly through London. I can only suggest one hypothesis in explanation. It is well known that from 1489 onwards the Tudor monarchs passed a series of "Depopulation Acts," to prevent the conversion of arable land into pasture. It is not so well known that these Acts contained clauses requiring the arable land to be cultivated according to the custom of the district or county. We can, it seems to me, in this map see the wave of inclosure gradually advancing in a long line, creating, like all revolutionary changes, much suffering and discontent, till its crest reaches London, and then the legislature is stirred, and a legal barrier is interposed to any further advance. Similarly, we may explain the sharp line drawn across Dorset and Somerset; but here we are driven to ask the further question, why should inclosure have advanced from the south-west? Why should Devonshire in this respect be more advanced—in fact, by centuries—than Middlesex, Cornwall than Cambridge, Shropshire than Oxford? The explanation must be sought in the varying constitutions of the village community in different parts of Britain.

Influence of Racial History.—The type of English village community which

Seebohm investigated, taking Hitchin as his starting-point, is the Midland type. That is the type which I have also described as existing till recently in Castor and Ailesworth. You can find it still working in Laxton and Eakring, in Nottinghamshire. It is the type usually taken as most representative by the agricultural writers of a century ago. But it is, after all, a local, not a national type. I would suggest that we should call it the Mercian type. We can then distinguish also quite clearly the pure Keltic type, the Wessex type, and the type characteristic of Norfolk and Suffolk, which I would term East Anglian if I did not suspect that "Anglo-Danish" would be a better name. We can see, also, that there was probably a distinct Northumbrian type of village community obtaining from the Tees to the Forth, but, so far as I know, it is possible to give no complete description of its features. I have my suspicions, also, that the primitive village community of Kent had its special and peculiar features, but I know of no convincing evidence to support this position. The peculiarities of phraseology in the Domesday entries for Kent, and the prevalence of the custom of gavelkind, are suggestive, but they do not take us very far in reconstruction.

I do not want to enter upon the vexed and thorny question of the origin of the English village community, but for the purpose of grouping the facts, I would suggest the following hypothesis :—

1. That the English village community is essentially a hybrid institution, the result of the blending of Keltic custom (possibly already modified by Roman rule) with the customs of Angles, Saxons, or Jutes ; then, over a great part of the country, further modified by the intrusion of Norse settlers, from the time of Alfred onwards.

2. That the variation of type of the English village community in the different parts of the country is due to the difference in the strains of racial custom blended together in each locality.

3. That the varying structure thus arising gave the village community varying degrees of power of persistence ; so that the persistency of common fields is a test of the racial history of the neighbourhood.

The map of Parliamentary inclosure, with its thinning out of late surviving common fields towards the west, itself suggests these hypotheses, and suggests, further, that for some reason or other the Keltic type of village community lent itself most readily to early inclosure. We shall see the reason when we examine the institution known as "run-rig" in Scotland and Wales, "run-dale" in Ireland, "rig and rennal" in Caithness.

Run-rig.—The best accessible description of run-rig I know of is that by Mr. Alexander Carmichael in Skene's 'Celtic Scotland,' describing the customs of North Uist in the Outer Hebrides. This was written and published a good many years ago, but as late as May, 1904, Mr. Carmichael informed me that it still remained exactly true. English common field was aptly, if rather unkindly, hit off by Carew with the nick-name "mingle-mangle." Mr. Carmichael, equally aptly, but much more sympathetically, speaks of "the run-rig system of share and share alike." The land occupied by a group of families on the run-rig system is called a "town-land." Towards the end of autumn the constable calls a meeting of the inhabitants of the town-land. They meet, and having decided upon the portion of land to be put under green crop next year, they divide it into shares according to the number of tenants in the place, and the number of shares in the soil they respectively possess. Thereupon they cast lots, and the share which falls to a tenant he retains for three years. A third of the land under cultivation is thus divided every year. They observe as much accuracy in measuring the land as a draper in measuring cloth. In marking the boundary between shares, a turf is dug up and turned over

the line of demarcation. The turf is then cut along the middle, and half is taken by the tenant on one side, and half by the tenant on the other side, in ploughing the subsequent furrow; similar care being afterwards exercised in cutting the corn along the furrow. There are no fences round the arable fields, but the people have a protecting rig on the margin, which is specially shared out among the tenants to equalize the risk of injury from cattle straying in from the grass land. Occasionally, for limited bits of ground, the people till, sow, and reap in common, and divide the produce into shares and draw lots. The sheep, cattle, and horses of the town-land graze together, the species being separate. A tenant can only keep stock in proportion to his share in the soil, but he can choose the species. One mature horse is considered equal to two cows; one cow to eight sheep or sixteen geese; and younger animals are estimated at such and such fractions of full-grown ones of the same species. A common fund is maintained for the purchase of bulls and rams. During the early summer the stock is kept at night in inclosures, and two tenants in rotation watch to prevent their straying over the open fields. Early in June, tillage being completed, the people go to the hill-grazing with their flocks. They bring them into an inclosure, where each tenant's animals are counted, to see that he has not exceeded his proper number. Then the cattle are turned out to graze, and the "Shealing feast" is celebrated with singing and the eating of cheese.

Some chance phrases of the agricultural writers who contributed to the General Survey of Scotland made in 1793–4 will add a little to our comprehension of run-rig in its perfection. Sir John Sinclair says, "Were there twenty tenants and as many fields, each tenant would feel himself unjustly treated unless he had a proportionate share in each." Mr. William Marshall, "Not the larger farms only, but each subdivision, though ever so minute, whether *plow-gait*, *half-plow*, or *horse-gang*, has its pittance of hill and vale, and its share of each description of land, as arable, meadow, green pasture, and muir." Dr. James Robertson defines run-rig as "Two or three or perhaps four men yoking their horses together in one plough, and having their ridges alternately" (*i.e.* in rotation) "in the same field, with a bank of unploughed land between them, by way of march."

We see plainly that run-rig, like common field, was based on co-aration; but that it differs from common field, because it further involved the practice of the periodical redivision of the land, and the principle of equal sharing among tenants in proportion to the number of horses they contributed to the common ploughs. We see, further, that the redivision and equal sharing of the land in Scotland, as in Russia, persisted after co-aration had been abandoned.

Now obviously, if the land is redivided among a number of cultivators who had practised co-aration, after they had abandoned that practice, and adopted individual cultivation, if only once, the land would be portioned out among them in as compact and convenient lots as possible, and then, when, as an old writer puts it, the spirit of inclosure enters into some rich churl's heart, he can set the example of hedging and ditching without having to overcome the difficulty of his lands consisting of acres or half-acres scattered over several square miles and intermingled with those of his neighbours.

It is easy, therefore, to understand why the Keltic type of village community should lend itself to early inclosure. Further, there is nothing startling in the hypothesis that in the western half of England the primitive village community was of the Keltic type, and that this fact accounts for its early inclosure.

Run-rig in England and Wales.—We find, from the reports to the Board of Agriculture Survey, in 1793, that open field had practically entirely disappeared from Wales, but some few examples still remained of open intermixed arable lands, to which the description of "lands in run-rig" was applied, in places where lay and

ecclesiastical property was intermixed. Devon and Cornwall were inclosed at a very early date, though, curiously enough, Braunton Great Field still survives in the open state; but a custom survived which is evidently akin to run-rig, by

which tenants of a manor were allowed to temporarily inclose portions of the waste of the manor, plough and take two crops, and then the land so cultivated again became common pasture. A similar custom, except that four crops were taken in succession instead of two, was the custom of Staffordshire in the seven-

teenth century; and it also was found at the end of the eighteenth century in Warwickshire. As we come further north, still keeping to the western side of the country, we find inclosure later and later. A good deal of inclosure of intermixed arable land was effected in Lancashire quite late in the eighteenth century, but it was brought about by voluntary exchanges, no Parliamentary proceedings being found necessary. Eden, in his book on the state of the poor law, and the poet William Wordsworth, in his 'Guide to the Lake Country,' give us a very clear view of the inclosure of arable lands in Cumberland. Eden describes the condition as to inclosure of a good many Cumberland parishes. The arable land was intermixed in long narrow strips called "dales," or "doles," very significant names wherever they occur, firstly, because we have the same word in "rundale," another name for run-rig; secondly, because etymologically the name "dales," or "doles," means lands which are in some way or other dealt out to their proprietors or occupiers. Between the "dales" were broad grassy balks, as they would be called elsewhere, in Cumberland known as "ranes." In some few cases these open arable fields in Cumberland and Westmoreland were dealt with by Inclosure Acts, happening to be taken into the scope of an Act which was mainly passed for inclosing common pastures.

Wordsworth shows that previous to the union between the crowns of England and Scotland holdings were let to partnerships of four tenants, each of whom, we may presume, contributed a horse to the common plough. The group divided its holding into four equal parts; but, says Wordsworth, "These divisions were not properly distinguished; the land remained mixed; each tenant had a share through all the arable and meadow land, and common of pasture over all the wastes. . . . The land being mixed, and the several tenants united in equipping the plough, the absence of the fourth man" (when called out on military service) "was no prejudice to the cultivation of the land, which was committed to three." In other words, the Cumberland system was "run-rig." Though the inclosure of its arable fields was not completed till the nineteenth century, and was proceeding at a time when Acts of inclosure were being passed by scores or hundreds every year, only by accident was the Parliamentary process called in to effect inclosure in this district.

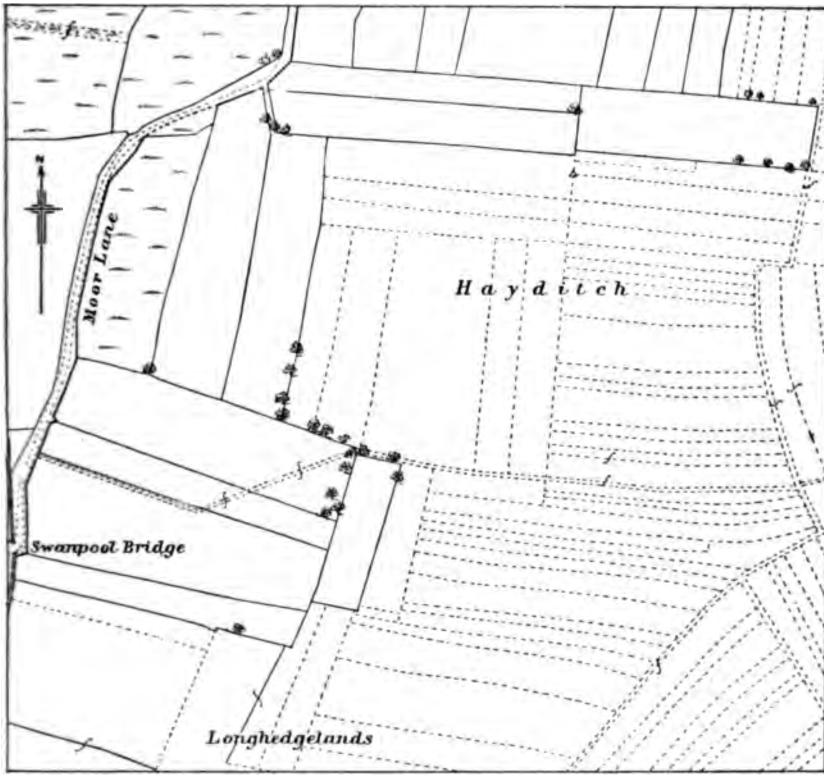
The hypothesis, that right through the unshaded area of the map of England on the western side the primitive village community was of the Keltic type, is, I submit, supported by the evidence.

Saxon Custom.—At this point, however, the question may naturally be asked, "What are the characteristics of the pure Saxon or Anglian village community?" The answer must be sought in the districts from which our Anglo-Saxon ancestors came. Throughout the district which is believed to have been the continental home of the Angles and Saxons the ancient traditional system of cultivation was the "one-field system," the peasants' holdings consisting of intermixed strips of land in open fields, which are not intercommonable, but are all the year in the separate occupation of their several proprietors, and which, by manuring, are made to bear crops every year. This, I would suggest, is the system which would naturally arise among a people who originally betook themselves to agriculture from fishing; for seaweed, fish refuse, and unnecessarily large catches all supply rich manure, and the fisherman is naturally disposed to intensive cultivation of land near his home. On the other hand, run-rig is a system that would naturally arise among a pastoral people when first taking to agriculture. That, however, is by the way.

Is it not at least conceivable that the Mercian type of village community is the hybrid product of the blending of the Keltic and Anglian types? Under Saxon influence the periodic redivision of the land is abandoned. The three-field system

of two crops and a fallow, may well have arisen as the result of the blending into harmony of the Saxon one-field system with the Keltic custom of taking two crops and then allowing the land to revert to common pasture. As we examine the Wessex and Norfolk systems we shall see that these also can equally be understood, as arising from the combination of the same elements; and, indeed, in these the constituent elements are more clearly distinguishable.

The Wessex Village Community.—I was fortunate enough to discover an excellent example of the Wessex type of village community in Stratton and



Part of Braunton Great Field.

Grimstone, two hamlets near Dorchester, where the old customs survived up to 1900. The villagers there held their farms on a copyhold tenure of three lives renewable. The holdings were "livings" or "half-livings," which we may compare with the "plow-gangs" and "half-plows" of Scotland. Each "living" carried a right of common of pasture for two horses; each "half-living" for one horse. In Fordington, which adjoins Dorchester itself, the holdings were "livings," "half-livings," and "farthing-holds," and a whole living carried a right of common of pasture for four horses. The lands of Stratton and Grimstone consisted of commonable meadows along the river Frome, open common arable fields stretching up the slopes of a hill, with common sheep-downs beyond. The whole

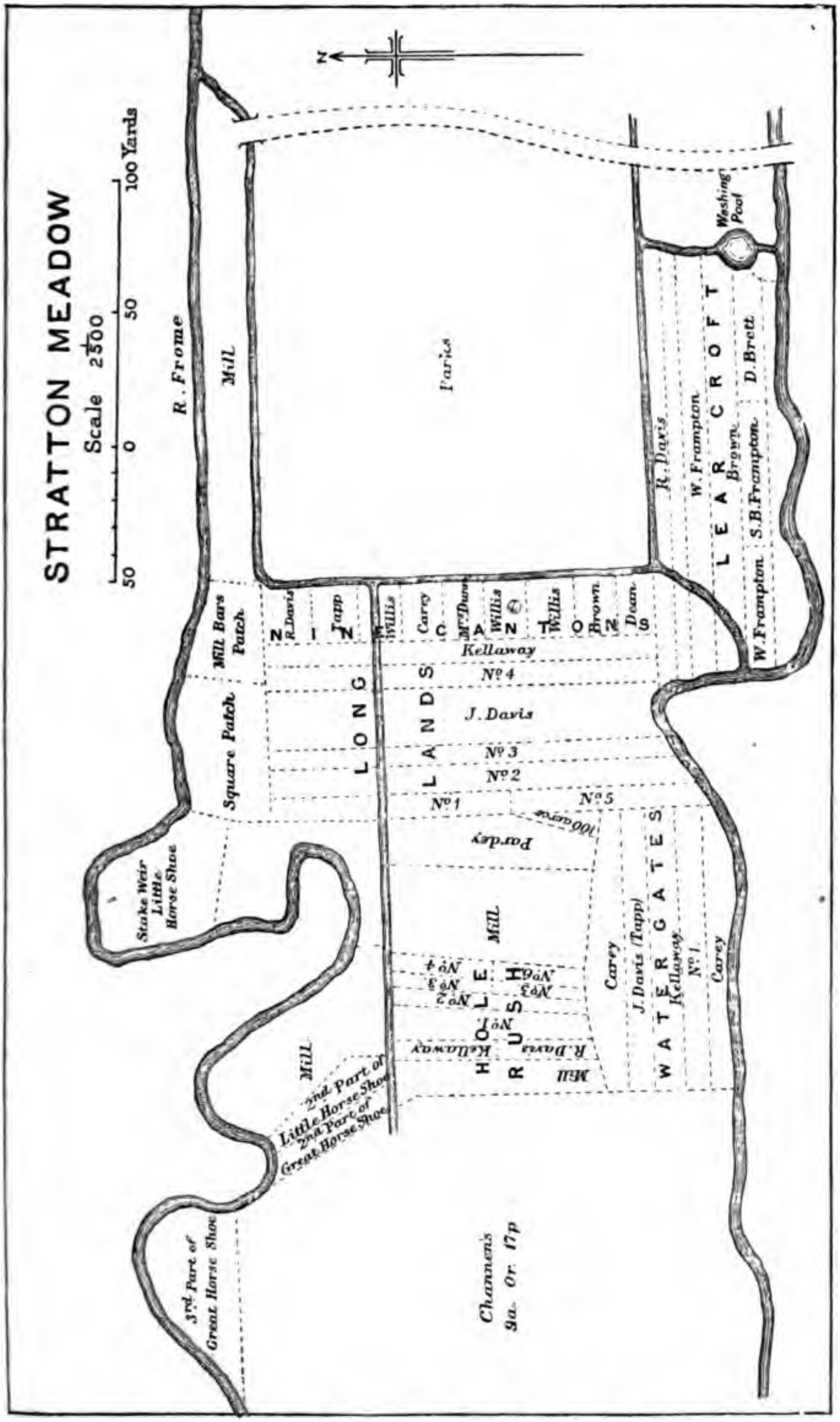
livings had about 10 acres of land each in the arable fields, proportional shares in the meadow, and common rights for two horses, four cows and eighty sheep. The half-livings had about half as much land, and common rights for one horse, two cows, and forty sheep. But, curiously enough, there were above the arable fields certain inclosures taken out of the down, called "doles," each about an acre, similar in shape and in distribution to the strips of land in the common fields. Further, there were taken out of the down certain square inclosures, called "new closes," and each tenant, whether occupying a living or a half-living, had one dole and one new close. Perhaps we can see here a touch of the run-rig principle of share and share alike.

In Stratton and Grimstone, too, annual meetings of the tenants were held for the election of the village officials, the constable, the viewers of the fields, and the hayward, who kept charge of the pound. The office of village constable disappeared with the establishment of the county constabulary. The "viewers" then became, if they were not so before, the chief village officials. They procured the common bull. They saw that each man served his turn in the repair of a bridge, and in carrying water up to the troughs on the sheep-down, and in other ways they enforced the decisions of the village meeting, and guarded the interests of the community. In all these respects these Dorset manors closely resemble the "towns" of North Uist. Lastly, we have what I believe is a trace of the Keltic custom of redivision of the land in the management of the meadows. These were commonable after the hay had been cut, as in commonable meadows in the Midlands. But here while some of the strips into which they were divided were definitely attached to certain holdings, others were interchangeable, and belonged in rotation, to two, four, six, or eight different tenants in successive years. The accompanying map is a copy of that used by the viewers in the annual partition of the meadow. The strips of land with farmers' names, as "Carey," "Pardey," are definitely attached to particular holdings; the others are interchangeable. This custom was a feature of the common field system in many villages in the south of England.

One further custom is of special interest. On the lower half of the arable fields, the part which was both more fertile and nearer the village, after successive crops of wheat and barley, clover was sown, so that this part of the field bore crops every year. This was called the "hatching-ground." The sowing was under supervision of the viewers, and the clover was fed off by the combined flock of sheep belonging to the whole manor, under the charge of the common shepherd. This custom was frequent, but not universal, throughout Wessex. In places the land so cultivated was called "hook land," elsewhere "hitched land," and to follow the custom was termed "hitching the fields." We may regard this feature in the Wessex system as originally based on the Anglo-Saxon one-field system, so far as its form is concerned; but in spirit it has become thoroughly Kelticized.

In the Mercian village the Keltic and Teutonic strains are exactly balanced; in the Wessex village the Keltic strain predominates. The Wessex type of village community, we may note, lent itself much more readily than the Mercian type to inclosure. (Compare the map for the East Midlands with that for Hampshire, Surrey, and Sussex.)

The Norfolk Village Community.—The preambles of Norfolk Acts of inclosure read peculiarly. A typical one reads, "Whereas there are in the parish of Sedgeford, in the county of Norfolk, divers lands and grounds called whole-year lands, brecks, common fields, half-year or shack lands, commons and waste grounds, . . . and whereas there are certain rights of sheep-walk, shackage, and


STRATTON MEADOW
Scale 1/2500
50 0 50 100 Yards
R. Frome
Mill
Paris
Washing Pool
R. Davis
W. Frampton
LEAR CROFT
Brown
D. Brett
S.B. Frampton
W. Frampton
Mill Bars Patch
Square Patch
LONG LANDS
Kellaway
Nº 4
J. Davis
Nº 3
Nº 2
Nº 1
Nº 5
Pardey
Stake Weir Little Horse Shoe
Mill
HOLE RUSH
Carey
J. Davis (Tapp)
Kellaway
WATER GATES
2nd Part of Little Horse Shoe
2nd Part of Great Horse Shoe
3rd Part of Great Horse Shoe
Channens
9a. 0r. 17p

common over the said brecks, half-year, or shack lands, commons and waste grounds, and great part of the said whole-year lands, as well as the brecks, common fields, and half-year or shack lands, are inconveniently situated," etc. Other Norfolk Acts mention, as lands which must be dealt with, doles, ings, carrs, and buscallys.

It would be wearisome to investigate the precise meaning of these various expressions; but, in the first place, their very variety is striking compared with the enumeration one meets with in Acts for parishes outside Norfolk and Suffolk, which commonly runs at its fullest, "divers open and common fields, meadows, pastures, waste lands, and other commonable lands." Next one notices the three distinct forms of rights exercisable over the parish lands, viz. common rights, which might be enjoyed by labourers as pertaining to their cottages; right of shackage, which is the right of the occupiers of lands to pasture cattle on one another's holdings after harvest; and right of sheep-walk, which is a right of the lord of the manor to pasture flocks of sheep on open lands at certain times of the year—the right referred to by Tusser, "The flocks of the lord of the soil do yearly the winter corn harm." We may see in this exact definition of rights of different classes a Teutonic characteristic.

But the most significant feature of the Norfolk village community is that of the "whole-year lands." These, as the preamble quoted indicates, were intermixed, but they were not commonable. In some Acts they are described as "whole-year or every-year lands;" they are "whole-year" lands because they are all the year in individual occupation; they are "every-year lands" because they are made to bear a crop every year. In other words, they are lands held and cultivated in just the same way as the village lands in North-West Germany. While the Wessex type of village community differs from the Mercian in resembling more closely the Keltic parent, the Norfolk type, on the other hand, is more impregnated with Teutonic influence.

In Lincolnshire.—The type of village community extinguished by Inclosure Acts in Lincolnshire and the East Riding of Yorkshire approximated closely to the Mercian type, except that a two-field system, *i.e.* a system of alternate crop and fallow, was very prevalent. We find, however, some notably peculiar cases. In the Isle of Axholme every cottager possessed a right of common over the vast swampy pastures which separated the isle from Yorkshire on one side and Lincolnshire on the other; and owners of land, as such, had no rights of common. In consequence the cottagers were able, when the marshes were divided, drained, and inclosed, to defeat the proposal to also inclose the arable fields, and these remain to the present day, to a very great extent, open and intermixed. The people are proud of their very ancient system, and of their superior husbandry; and of late years Mr. Rider Haggard has done much to make it famous. Up to about fifty years ago these arable fields were commonable, to the following very limited extent—that on some day in October notice would be given by the pindar that the fields were to be broken, and then cattle would be turned out to graze on one of the four arable fields belonging to each village, under the charge of the pindar, until November 23; and the pindar lit huge fires at night, round which the boys gathered to roast potatoes in the embers. But that custom has died out, and the open fields of Axholm may be described as glorified allotments. Axholme is singularly well fitted by geographical position to be the last refuge of a dying system; the singular fact is that there is a possibility of its also being the starting-point of a new one.

The other peculiar case is that of Stamford, described by Arthur Young in the following words: "Lord Exeter has property on the Lincoln side of Stamford that

seems held by some tenure of ancient custom among the farmers, resembling the *run-dale* of Ireland. The tenants divide and plough up the commons, and then lay them down to become common again; and shift the open fields from hand to hand in such a manner that no man has the same land two years together; which has made such confusion that were it not for ancient surveys it would now be impossible to ascertain the property." We may add here William Marshall's comment: "In regard to commons, a similar custom has prevailed, and indeed still prevails, in Devonshire and Cornwall; and with respect to *common fields*, the same practice, under the name of 'run-rig,' formerly was common in the highlands of Scotland, and, perhaps in more remote times, in Scotland in general." We have here the pure Keltic custom, maintained by some accident in an isolated spot, in the very midst of the country in which the Teutonic element most strongly predominates.

I have referred to a Northumbrian type of village community. It was a type that lent itself to early inclosure. One of its characteristic features was the distinction between infield and outfield. The infield, like the Norfolk every-year lands, was made to bear a crop every year. To make this possible, it received all the manure which was produced. The outfield was ploughed and sown one year, and then left fallow until it was supposed to have recovered its fertility unaided. This was the custom also in the Yorkshire Wolds up to the time of their inclosure; and in the Lothians it persisted after the intermixture of farms and holdings had disappeared. From casual expressions in the few Inclosure Acts for Durham and Northumberland, and from the fact that inclosure took place at an early stage in agricultural evolution, and with little difficulty, I should infer that in other respects the Northumbrian system approximated in character to run-rig. This is also suggested by the remarkable degree of equality of holdings which is shown to have prevailed in Durham in the twelfth century by the 'Boldon Book.'

Arable and Pasture Districts.—I have grouped the facts with regard to the geographical distribution of Inclosure Acts on the thread of varying local racial traditions. But there is also a more direct connection between the geographical conditions of a district and its village history. The accomplishment of the inclosure of the arable fields by the gradual and voluntary action of individuals is comparatively easy where the country is mainly pastoral, for three reasons. Firstly, because there is less to be accomplished. Secondly, because the right of common pasture over the arable fields after harvest, which is one of the great obstacles to voluntary inclosure, is less valuable, and less likely to be obstinately maintained. Thirdly, because the idea of inclosure, *qua* inclosure, was far less unpopular, and far less reprobated, in pastoral districts than in corn-growing districts. Where the open land is mainly devoted to corn-growing, a hedge is something to keep cattle in, and to inclose means in practice to convert tilled land to pasture, hence to diminish the production of food in the locality, and to diminish the employment of labour. On the other hand, where the open land is mainly common pasture, men put hedges up to keep cattle out, and to till the land within the hedge; and the idea of inclosure is associated with increased work, increased production of food, and increased local prosperity.

Hence we can see the reason for the geographical range of riots and rebellions against inclosures. The complaints of inclosures which led to the Inquisition of 1517 all came from the districts I have termed the "Belt of Parliamentary inclosure." The riots and rebellions of 1549 began in Somerset and spread eastwards, and reached their climax in Norfolk. The Devon men were simultaneously in rebellion, but not on the grievance of inclosure. The riots in the reign of James I.

were in Northamptonshire and Leicestershire, the counties which a hundred years later had respectively the highest and the seventh highest proportion of known arable common field.

Effects of Early Inclosure.—It is also necessary that we should consider from the geographical point of view the effects of inclosure. Take first its effect on the face of the country. According to the time and manner of inclosure do we find, as the result, the landscape cut into little fields with great hedges, looking from an elevated point of view like a patchwork quilt; or the natural sweeping lines of the hills only slightly emphasized by skimpy quickset hedges. In the country of old inclosure we find narrow winding lanes; in the "Belt of Parliamentary inclosure" broad straight roads with margins of grass on either side, occasionally with nothing but grass and cart-ruts. You find here almost all the houses of a parish clustered together in compact villages; while in the country of early inclosure they may be so scattered, that if it were not for the church, which seems to attract to its neighbourhood the inn and the smithy, there would scarcely be a recognizable village at all. William Marshall, the keenest of the agricultural observers of a century ago, was accustomed to infer the date and method of inclosure of a district from its aspect alone; and I have never found his judgment at fault.

More important is the geographical variation in the results of inclosure upon the condition and character of the peasantry, who, no less than the land, may be said to have undergone inclosure. Where, as in Devon and Cornwall and the west generally, the division of intermixed arable and meadow land took place early and gradually, and in subordination to the reclamation of waste, that reclamation itself being carried on gradually, the result was the creation of numerous small holdings and properties. In the process a career was offered to the enterprising and laborious, and enterprise and industry grew accordingly. "Devonshire, myghty and strong," says Leland, and a generation later the county justified the tribute. The great part taken by Devonshire in the national struggles in the reign of Elizabeth must be partly attributed to the reaction upon the character of its people of the conquest over the difficulties of bringing the rocky soil from woodland and moor into a state of cultivation, a conquest which made Devonshire husbandry famous for two generations, and "Devonshiring" a well-known term for a particular method of bringing waste land into cultivation. When the inclosure of the county was complete, Devonshire, which in the time of Domesday had a very large percentage of slaves and a very small percentage of free men, was distinguished by the number of its yeomen. But in consequence of the very completion of inclosure the field for enterprise was closed; Devonshire husbandry first ceased to deserve its repute, then lost it.

Effects of Parliamentary Inclosure. I. The Midlands.—Inclosure in the Parliamentary belt worked very differently and with important variations in different districts. In the Midlands, inclosed almost entirely during the eighteenth century, the effects were most drastic and sudden. Before inclosure this was a district of great cornfields, cultivated by a hard-working peasantry. "In those happy times," as a contemporary writer puts it, "you might view the farmer in a coat of the growth of his flock, spun by his industrious wife and daughters, and his wife and daughters clad from their own hands of industry and their own flock. . . . You will find him entertaining his friends with part of a hog of his own feeding, and a draught of ale brewed from his own malt, presented in a brown jug, or a glass if it would bear it." In a typical case recorded, twenty such farms and the cottage holdings of sixty cottages were amalgamated, and the whole parish re-divided into four grazing farms, managed with the assistance of four shepherds. In Leicestershire leases at the end of the eighteenth century

commonly forbade even an inch of soil from being ploughed. As you travel by the Midland or Great Central, you can see the ridges of the old arable common fields, because wherever the soil was heavy they were always ploughed the same way, and so became heaped up in the middle. You can trace them going, as it were, through hedges, and ending in the middle of the field, showing clearly that all those lands were laid down in grass on inclosure, and have scarcely, if ever, been ploughed since.

II. The South.—In the great chalk and sheep-down country, to which belong most of Wiltshire, much of Dorset, Berkshire, Hampshire, Oxfordshire, and parts of other counties, inclosure was not generally accompanied by the conversion of arable into grass in the eighteenth and nineteenth centuries; but, nevertheless, local depopulation resulted. In this country, before the inclosure period, which was somewhat later than in the Midlands, the most usual type of farm was one "yardland," *i.e.* about 18 acres of arable and scattered over the common fields in about twenty separate parcels, with a few acres in the common meadows, and pasture for about twenty sheep on the downs. The services of the common shepherd, and all the other devices of mutual help belonging to the common-field system, were essential to the success of farms of this type in this country. Upon inclosure, the old tenants were left undisturbed; but afterwards small farms gave way by degrees to big ones, and the tenants of yardlands were slowly degraded into landless agricultural labourers.

III. The East.—In Norfolk and parts of Lincolnshire and Yorkshire inclosure was accompanied by a great extension of arable farming, a greatly increased production of food, and an increased local population. Norfolk husbandry was deservedly famous from about 1770 onwards. Rents and farmers' profits increased enormously, and the demand for labour exceeding the supply, agricultural wages tended to rise; but this tendency was kept in check by the development of the agricultural gang system, a system by which men recruited gangs, generally of boys and girls, transported them, perhaps considerable distances, to the farms on which they had contracted to execute agricultural work, and made their profit on the difference between the contract price and the time wages paid to the women and children they employed.

The inclosure of common fields is, it is clear, a feature of our national history, which needs to be viewed from the geographical, as well as from the legal, agricultural, economic, and social points of view, to be fully understood. Yet in treating it from the geographical point of view it is necessary also to bear in mind the existence of all these other aspects. I would like to suggest the thought that the break up or decay of the English village communities has been a most important factor in the evolution of the nation during the past four or five centuries; that it has had influences, which are not yet sufficiently recognized, upon the development of urban industry, internal commerce, banking, pauperism, the relationship between class and class, and the moral qualities and intellectual outlook of the common people. Lastly, I would suggest that for any nation the breaking up of its village communities must necessarily be a crisis in its national life; that if we forget this we shall miss much of the significance of the recent history of Western Europe, and of the contemporary history of Eastern Europe and of Asia.

THE STRUCTURE OF SOUTHERN NIGERIA.*

By JOHN PARKINSON, B.A., F.G.S., Principal of the Mineral Survey.

In the following pages I have endeavoured to give some account of the structure of Southern Nigeria, dealing, in the first place, very briefly with the geology of the country, and in the second with the salient features of the physiography. The intimate relation existing between these two sub-heads need not here be emphasized.

Since the winter of 1903, various journeys have been made by the Mineral Survey of Southern Nigeria, working under the Colonial Office and the Imperial Institute, for the purpose of ascertaining the mineral resources of the colony. In so brief a time and in so large a country, it will be obvious that a complete examination is impossible, and, moreover, it should be borne in mind that much of the north-eastern corner of the colony adjacent to the Kameruns boundary, and including the headwaters of the Katsena, has not yet been brought fully within the sphere of British influence. This tract of unexplored and unknown country extends westward as far as the Niger, and it is possible that a later survey of this very large proportion of the colony may modify some of the statements hereafter made.

No part of the district lying between the Cross river and the Niger has been visited by me, and the following remarks apply, firstly, to the region of the Oban hills and the valley of the Cross river, so far as this is contained in British territory; secondly, to a traverse from Sapele northward, through Benin city, Ifon, and Owo, to the Northern Nigeria frontier; thirdly, to the district around Asaba; and fourthly, to certain parts of the Lagos province, especially the Ijebu country. The routes taken are marked on the map.

In order properly to understand the structure of Southern Nigeria, it is necessary to realize the position and extent of the old floor of crystalline rocks now exposed at the surface. The members of the geological series found in Southern Nigeria are but few, and of these the granites, gneisses, and schists are by far the oldest. Upon their worn and eroded surfaces all † the later sediments were lain down, and although it cannot be truly said that they invariably produce a distinct type of scenery, there can be no doubt of their fundamental importance as factors in producing the physiography of the colony. The nature of these sediments depends on the distance they were deposited from this old land surface, while the positions and magnitudes of bucklers of crystalline rock must have modified greatly the form and extent of the foldings subsequent to their deposition. To both of these factors the scenery is directly related. The southern boundary of these old rocks runs from Abeokuta, eastward and a little south of 7° N. lat., but near the Niger turns northward, crystalline rocks being first seen, according to Gürich, at 7° 19′ N. lat. To the east, as will be seen from the map, a large hiatus appears over the unknown country referred to above, and the rocks are not found again, with certainty, until we arrive in the neighbourhood of the Oban hills.

The researches of Solger,‡ Esch, and others have proved, not only the occurrence

* Read at Section E, Geography, York Meeting of the British Association, August, 1906.

† With the exception of some phyllites and grits near Uwet. These rocks may have a greater subterranean extension than is at present known.

‡ 'Geologie von Kamerun,' and numerous papers.

of closely similar gneisses and schists in the Kameruns, but also representatives of the Mesozoic and Tertiary sediments, so that in all save its volcanic phenomena the Kameruns may be considered as having shared in the geological history of Southern Nigeria.

Following the crystalline rocks in importance, the Cretaceous system is, in my opinion, the most noteworthy of the later sediments. Sweeping round the old shore-line of the Oban hills, these rocks, with a few small exceptions form the banks of the Cross river, often low and monotonous, but now and again, as near Itu and Ungwana, rise into bold ridges.

My work has not taken me further up the Cross river than Itaka, about 10 miles below Abokam, on the Kameruns frontier, and at the latter town we reach, I believe, the limit of the Cretaceous rocks, which, however, certainly extend northward up the Aweyong river at least as far as the entrance of the Moya creek. They have also been traced from Afikpo to Abakalliki,* and doubtless extend for some distance to the west and north. So far they have not been found in Southern Nigeria west of the Niger.†

While the type of country produced by the Cretaceous sediments does not greatly differ in some instances from that of the crystallines, yet in other districts, *e.g.* Afikpo, we find a very characteristic relief. On the other hand, the third or Tertiary member of the tripartite division into which for present purposes we have divided the geological series, forms typically a country of low relief, usually gently undulating. Such a country is characteristic of the southern parts of the Lagos and Central Provinces. Beds of different ages are doubtless included among the Tertiary rocks, but the most conspicuous is the red sand or clay which is found almost everywhere in the neighbourhood of Benin, forming the series which I propose to call the Benin Sands. The prominent hills of Adiabo and Calabar, prominent because of the swamps by which they are surrounded, are formed of these red sands; they compose many of the rounded ridges near Asaba, and form the surface soil of much of the Ijebu country.

It may be well at this point to remark on the great difficulty presented to the geologist and physiographist alike by the dense forest which covers a very large part of Southern Nigeria. It is only too rare that from a suitable elevation outlooks over the surrounding country may be obtained, and while we may from such positions study the rounded knolls and ridges of the Kukuruku hills or the sharper and more abrupt peaks of the Obans, when once plunged in the bush we are buried in a tangled mass of creeper-laden vegetation, unable to see 30 feet before or behind, or even to follow with the eye the stream which we hear plainly below us in the valley. I venture to think that few can realize what a handicap to research the forest is until they have personally experienced the way in which it hides rocks and valleys alike.

In addition to the three types of country formed by the three geological divisions, we have the very well-marked type of the mangrove belt of the delta and coast. Neglecting these swamps, which have been described elsewhere, the scenery of the three principal types will be outlined in order.

Taking firstly the crystalline rocks, we note the massif of the Oban hills on the east differs in many points from that of the Kukuruku and associated hills of very similar type on the west. With the latter we may group the gneisses and schists of Ibadan and Abeokuta, with which they are most probably continuous, and

* N. lat. 6° 19′ 18″, L. H. L. Huddart; E. long. 7° 0′ 0″.

† Probably an exception occurs on the right bank of the Niger opposite Ida.

endeavour to compare the two areas. Owing to varying distances from the sea, and partly, perhaps, to difference in latitude directly affecting the vegetation, the traveller is struck at first more with the relatively sparsely forested character of the Kukuruku as compared with the Oban hills, though the deeply incised mass of the latter cannot fail to impress him.

From the physiographical point of view the Oban hills are a study of some difficulty. Speaking generally, they may be described as a collection of unorientated hills, culminating to the east-south-east of Ibum in a group of peaks rising to 3000 or 3500 feet above sea-level, the whole characterized by exceedingly steep slopes. There is distinct evidence of a radial drainage system, which on additional mapping will, I believe, become still more obvious, originating from the high group of peaks just mentioned, while the main watercourses are exceedingly tortuous and encumbered by rapids and small falls. During the dry season (say November to March) these streams, so far as I know, are fordable almost at any place, while the occasional rise during the rains cannot be much under 25 feet above the March level. An estimate * by aneroid of the fall of the main stream of the Calabar river for 5 or 6 miles above Uwet is 50 feet to the mile; the constant rapids by which this river, in common with the others of the Oban hills, is encumbered do not however, extend beyond the boundaries of the crystalline rocks. The lowest rapids of the three southward-flowing streams (the Calabar, the Kwa, and the Akpa Iyefe) draining the Oban hills lie almost in a straight line, and mark nearly, though they are always a variable distance above, the line of boundary between the crystalline and sedimentary rocks. In the case of the Calabar river the distance is about a mile, in the Kwa about 5 miles, in that of the Akpa Iyefe about 1½ mile. We may perhaps assume that these falls originally formed on the actual junction, and that each has worn back so that the line of rapids now stands to the north of its original position. The valley-sides throughout this district are steep; two measurements of the slope of the Calabar river south of Ibum give angles of 30° and 33° respectively, that of the banks of the Kwa near Abuton 41°.*

A discordance in grade between the tributaries and main streams leads to the formation of hanging valleys, of which typical examples may be seen near Uwet and Abuton, as well as in the hills themselves. The usual explanation of elevation initiating greater erosion of the main valleys with which the tributary streams are unable to cope, seems applicable here; but the history of the drainage system is complicated by the uncertainty as to whether the Cretaceous strata ever entirely covered the crystalline rocks. Except quite close to the latter, no outliers of the former have been so far proved. Undoubtedly, before the old rocks were submerged beneath the Cretaceous sea, a drainage system, probably a mature system, had been established, and it is the relation between the pre-Cretaceous and post-Cretaceous rivers that presents many points of difficulty. The unfolded condition of the Cretaceous rocks in the immediate neighbourhood of the hills goes to prove that the post-Cretaceous movement was of the nature of a simple rise and fall. On elevation, the natural dip of the sediments, due to deposition and away from a partially buried land surface, would doubtless give rise to consequent streams flowing outwards to north, south, and west; but the observed dip is greater than that naturally due to deposition, and my impression is that the central part of the hills was elevated relatively to the edges, probably by a north and south movement, producing a more marked dome structure than could arise from simple uplift.

The post-Cretaceous streams would tend, after removal of the Cretaceous rocks, to revert to the earlier pre-Cretaceous lines of drainage. The rejuvenation which has resulted in the formation of the hanging valleys is, however, quite probably

* Taken by Mr. L. H. L. Huddart, A.M.I.C.E., A.R.S.M., etc.

due to a later movement, for the sands of Calabar (Benin Sands) stand at elevations of 100 to 300 feet above sea-level, and, as above indicated, are undoubtedly much later than Cretaceous in age.

Passing to the Southern Nigerian portion of the Kukuruku and associated hills, we notice as a characteristic feature of the scenery the occurrence of rounded knolls and ridges. In some instances, at least, these appear to be formed of harder rocks than those of the surrounding country, so we may conclude that in some instances, at least, they have resulted from differential erosion (monadnocks of American authors). Examples of such ridges are shown in Figs. 1 and 2, and attention may especially be drawn to the unusually level character of the remaining part of the country. Studying the plain from the top of one of these knolls or ridges, the enormous amount of denudation which must have taken place before this great, and in reality undulating, stretch of country could have been produced forces

FIG. 1.—HILL S.S.W. OF IDUANI, AKOKO HILLS.

itself upon the mind. The bed of the Ossi, a most important river, is, when viewed from such an elevation, a mere notch in the surrounding plain. The more luxuriant vegetation fringing the banks allows the eye to follow the curving course for a considerable distance. At the same time, it should be stated that when we view the hills themselves, as for instance from the path between Owo and Ipele, the rugged, steep-sided hills recall the Oban type of scenery. Like the latter, they are forested to the top.

The country to the west of Owo, towards Emure and Egpenni, carrying the drainage system of the Ogbese, recalls the drainage system of the Ossi lying between Owo and Ipele on the one hand, and the hills south of Iduani and Yayu on the other. In some instances, as in the little villages of Otua perched on steeply rising hills of hard schist, these elevated sites were chosen in older days as positions of defence from northern raiders.

The streams traversing this country are, as elsewhere, encumbered with rocks,

their courses are tortuous and the contained water exceedingly small in the dry season. Speaking generally, the relief is not nearly so pronounced on the west as on the east. Two peculiarities in the drainage system may be noticed here: the first is the small reservoir capacity of the catchment basin, occasioning quick rises in the water-level, and comparatively rapid falls in the amount of discharge; the second, the enormous amount of evaporation which must take place during the dry season. For many suggestions in connection with this subject I am indebted to my friend and late colleague, Mr. L. H. L. Huddart.

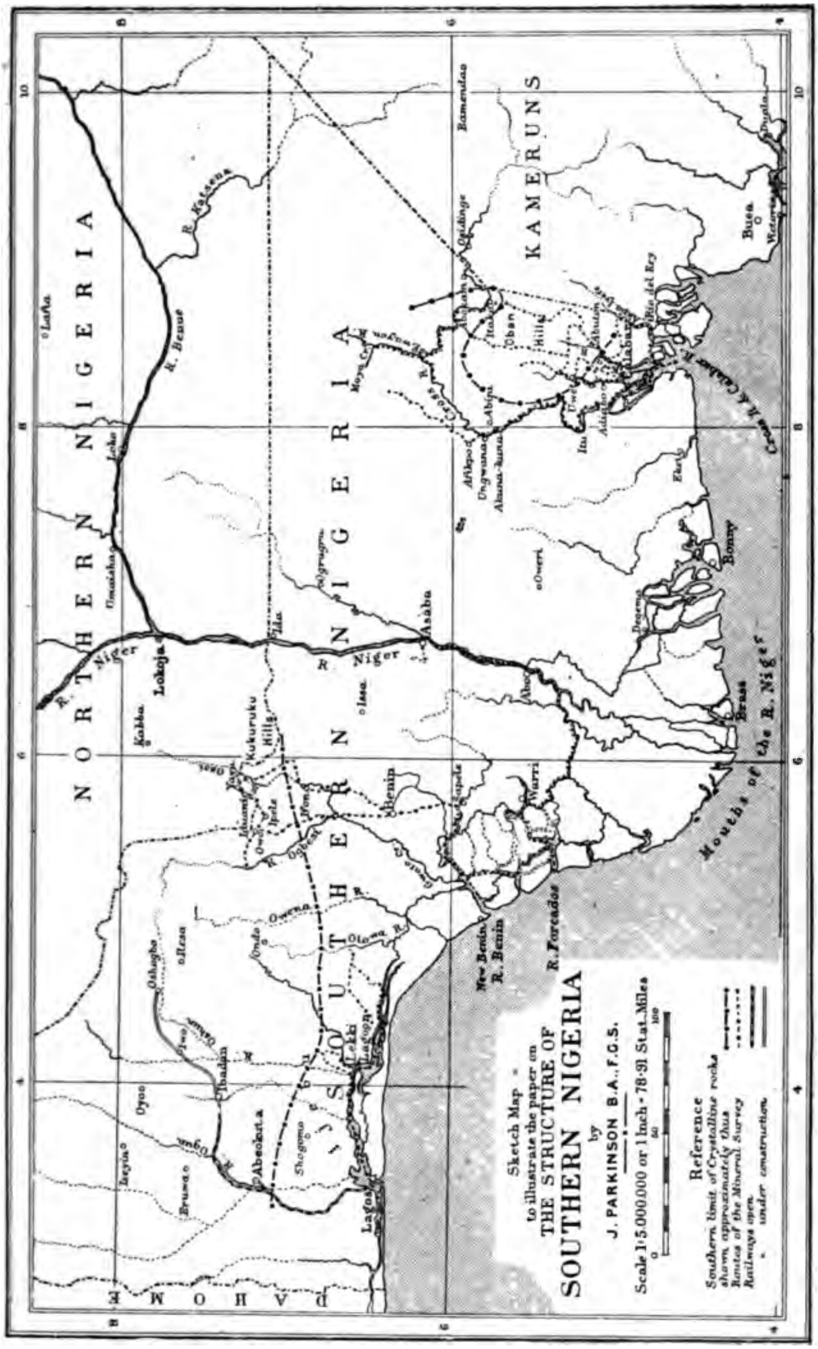
In a stream 60 or 70 feet in width the water is commonly but a few inches deep over the greater part of the bed, and in the heat of the tropical sun the evaporation must be very rapid. The interstitial water present in the sandy bed of the river is no doubt considerable, and in addition the slow process of filtration along the river floor may be important.

Much work requires to be done on the Cretaceous rocks, preceded by much exploration of at present untouched land, before the true history of this part of the physiography of Southern Nigeria becomes apparent, but in the Cross river basin some of the simpler phenomena may be briefly mentioned. A short excursion made in March from Akunakuna on the left bank of the Cross river to Abini, a distance of about 7 miles, served to show the great extent of the old flood plain.

It should be noted that the trend of the river there is roughly south-south-east, and that Abini lies approximately south-east from Akunakuna, the former town being mapped as about 3½ miles due east of the bank of the Cross river. Leaving Akunakuna, the ground is at first swampy, with small outcrops of sandstone and now and again doleritic sills; this type extends for the first 3 miles from Akunakuna, and is doubtless covered more or less by water during the rains. Passing this old flood plain, we find a second extending towards Abini, forming now an undulating stretch of country, the ground littered with pebbles, mostly of quartz, up to 6 inches in diameter. That this gravel is part of the flood plain, and not formed by the disintegration of a pebble bed of Cretaceous age, is indicated by the presence of limestone and shale fragments. Coarse sandstones form conspicuous ridges trending east and west in the neighbourhood of Ungwana, Afikpo, and the Edda hills, and give rise to a rather bold type of scenery, the more prominent as the ground is not densely forested. The sandstone scarps are left at the village of Abba, half a day's march to the north of Afikpo, but even so the country is exceptionally interesting, and after a long sojourn in the forest even fascinating.

From the station of Afikpo, ridge after ridge of white and yellow sandstone may be seen stretching away into the distance, and the march northwards across the grain of the country is a succession of gentle ascents up the dip slopes and abrupt descents over cut raw edges.

At Abakalliki, the most northerly station yet opened in the Eastern Province, built on the remnants of a cretaceous volcano, a most interesting view is obtained. Below the hills of agglomerate and pumice lies the undulating plain formed of sandy shales, while some 60 miles to the south rise the sharp granite and gneiss peaks of the Oban hills. About the same distance to the east, and on the further side of the Aweyong river, a second jagged range, as yet unvisited by a white man, is most probably a northerly continuation of the same crystalline massif. A third exceedingly well-marked ridge may be seen about 30 miles to the north-north-east, and recalls by its rather flat top the sandstones of Afikpo rather than the granites and gneisses of the Oban hills. This surmise requires confirmation from actual work on the spot, and we can only say that around Abakalliki we have an undulating sparsely forested extent of country, assiduously cultivated, drained by a well-developed series


Sketch Map
to illustrate the paper on
THE STRUCTURE OF
SOUTHERN NIGERIA
by
J. PARKINSON B.A., F.G.S.
Scale 1:5,000,000 or 1 Inch = 78·91 Stat. Miles
Reference
Southern limit of Crystalline rocks shown approximately thus
Routes of the Mineral Survey
Railways open
under construction
NORTHERN NIGERIA
SOUTHERN NIGERIA
KAMERUNS
DAHOME
R. Niger
R. Benue
R. Katsena
Lokoja
Kabba
Lagos
Abeokuta
Ibadan
Oyo
Benin
Asaba
Bonny
Brass
Calabar
Buea
Victoria
Duala
Mouths of the R. Niger
R. Forcados
R. Benin
Cross R.

of streams trending generally north and south and emptying into the Cross river. Of these the Aweyong is the most important, but numerous unmapped streams, such as the Aboina, exist to the westward, occupying as usual meandering courses containing but little water in the dry season, their vertical banks, some 30 feet in height, cut through alluvium and shales. Traces of old and extensive flood plains, now cultivated or used for grazing, are not difficult to make out.

The coarse sandstones lapping round the granite and gneisses of the Oban hills, and succeeded by shales and thin limestones, do not usually give rise to any characteristic type of scenery, or, in the dense bush that envelops them, exhibit contours strikingly different from those of the central crystalline massif. It is, indeed, often difficult, even when prepared, to detect the junction between the two series of rocks. As in other parts, the valley-sides are very steep, and with care one can often make out that the path is running along the crest of a ridge, with a rather deep valley on either hand.

The last group of rocks, viz. the Tertiary sediments, forms, from the Niger westward, a lowlying, undulating stretch of country bordering the sea and gradually rising to the north. This is typically densely forested, frequently swampy; the river valleys characterized by exceedingly steep slopes, and their courses by the meanders and accumulations of sand, distinguishing streams which have worn down to their base-levels of erosion and are depositing on their lower reaches. The very prominent sandbanks, often raised to considerable height above the dry-weather level of the stream, and stretching with but little break for a mile or more along the bed of the river, are perhaps the most striking feature of the lower reaches of all the Southern Nigerian streams. On the Niger and on the Cross river they extend for great distances from the sea, and are a serious obstacle to travel even in a small dugout canoe, which at low water has to be dragged tediously from one reach to another. Anastomosing rivulets of water force their way through the sand, making it often a difficult matter to decide upon the deepest channel; while, owing probably to seasonal changes in the disposition of the sediment, the natives are almost useless as pilots. Frequently striking examples of horseshoe bends may be observed, but I have not noticed any instances of the still later cutting by the river along the chord of the arc to produce the so-called ox-bow lakes. It is probable that a closer examination of the delta region would prove the existence of more high ground than is usually suspected, but, owing to the dense bush and fringe of mangroves, it is difficult to judge of the country without close and laborious investigation. At Asaba, Calabar, and Adiabo, the Benin sands rise to heights of 200 or 300 feet above sea-level.

In a paper on the post-Cretaceous stratigraphy of Southern Nigeria, communicated to the British Association at the York meeting (1906), I pointed out that, with the exception of the alluvium now forming, these Benin sands are the latest deposits found, and that they undoubtedly indicate an important subsidence in late Tertiary times. With the succeeding elevation, also not unimportant, we may see the inauguration of the present drainage system, and from this, I believe, the present physiography dates.

The type of scenery is characteristic. We find a flat or undulating country, the lower parts often swampy, where later alluvium has accumulated round the hillocks of eroded Benin Sands, the ground never rising to any great height, and here and there trenched by streams contained in steep-sided valleys. Viewed from the river, the hills on which Calabar stands appear to be eroded out of a peneplain, and it is probable that, could the surface of the country be studied from a suitable elevation, such peneplains would be more obvious than is at present the case.

FIG. 2.—VIEW FROM TOP OF AKOKO HILLS.

The extensive system of lagoons is one of the most prominent features in the physiography of the Lagos Province. On the west it extends through Dahomey * and Togoland as far at least as Kwitta, on the Gold Coast, while on the east it joins the ramifications of the Olowa and Owena rivers, connected with the Gwato creek and the beginning of the delta of the Niger. The rise of the rivers emptying into the Lekki lagoon during the rainy season is stated by the natives to be 6 or 8 feet, and the sediment there discharged and spread out over the surface of the lagoon must be very considerable, and sufficient to cause a rapid silting up of the whole. In one or two places the common red clayey sands form small hills, some 40 feet in height, bearing the same relation to the Yoruba rivers as do the Calabar and Adiabo hills to the streams of the Eastern Province; but these little eminences are rare, and do not detract from the general flatness of the country.

On the lower reaches of all the Southern Nigerian rivers, alluvial flats jut out into the stream and fringe the higher ground of the valley. Many of these flats are probably just awash at high floods, when a thin layer of silt is doubtless laid down. Frequently they are occupied by the farms of the villagers; and the rows of broad-leaved plantains, cassava, or yams form a pleasant change from the forest-clad slopes of the valley rising behind the monotonous stretch of dirty, sluggish river.

THE STUDY OF SOCIAL GEOGRAPHY.†

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THE label "Made in America" would characterize the subject-matter of the following paper in part only, for much of it has been suggested by the writing of men on this side the sea, and no doubt many will recognize herein old friends and foes.

At the outset, it may be as well to confess that students of geography are embarrassed by the fact that there is no consensus of opinion as regards either subject-matter or method. From the geography whose worthy ideal is discovery and exploration to the geography whose subject-matter is the "organic response to an inorganic control," is so far a cry that they seem to have little in common. Nevertheless, all aspects of the subject deal with *distribution in space*. Such a programme is well defined, and is capable of harbouring the most widely divergent conceptions of the task of geography.

However, it is not the purpose of this paper to examine titles or to set boundaries. The following discussion will be based upon the proposition that social geography deals with the distribution in space of social phenomena, and that its working programme may be stated as the "description of the sequence and relative significance" of those factors, the resultant of whose influences is the localization in space of the series of social phenomena chosen for investigation. Ultimately, by comparison with similar situations, and the elimination of the accidental, generalizations may be derived which will be of value in predicting the future distribution of similar phenomena. The subject deals, therefore, with the facts and products of human association as represented by group characteristics, industries, institutions,

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* See d'Albeca, "Le Dahomey en 1894," *Bull. de Géog.*, 1895, p. 185.

† Read at the York Meeting of the British Association, Section E, Geography, August, 1906.

technology, customs, beliefs, and related phenomena; and estimates the significance of the various factors which have influenced their distribution.

When a man buys a farm or locates a factory, his chief problems are those of distribution, and are, to that extent, geographical ones. Locating the site of a city, laying out the course of a railroad, the settling of territorial disputes, and a host of other important human activities, make large demands upon the subject of social geography in its various aspects. It is not necessary to emphasize the immediate and highly practical value of such a field of investigation. It remains rather to point out the more potent factors with which the student must deal, and to make a brief survey, from that standpoint, of the more fruitful lines of study towards which one desiring to undertake such investigation may most profitably address himself.

It is trite to note that the response, in terms of distribution, of a social group to a given environment is determined, not only by the "physical circumstance," but by the status, both technical and psychical, of that group as well. It is therefore essential to consider the historical, psychical, and technical elements in addition to the physiographical ones, if an adequate survey of any field of social distribution is to be made. For example, the American Indian, roaming over the Mississippi valley, devoted himself to hunting, and better weapons in the form of guns served only to confirm him in this lower stage of culture by making him more successful therein. The European, pouring over the Appalachian barrier into this same valley, addressed himself mainly to agriculture long before the constraining factor of lack of space became potent in moulding that choice. While the large majority were thus engaged, a few here and there, as if afflicted with a sort of social atavism, gave themselves over to the life of the hunter, in many instances actually joining the Indians and taking delight in their ways of living. Another remnant, more adaptable than their degenerate cousins, but with the same restless fire burning within them that drove their people across the seas and the hills, took up the essentially nomadic activity of transportation, and the various facilities for communications within that region stand in a way as monuments to their success.

As the great stream of westward migration filtered through the eastern highlands, eddies of the current carried many into the closed valleys of Kentucky and neighbouring states, where three millions of them still remain, a remnant of the England of Chaucer, keeping alive the feud of the Scotch highlander, and singing folk-songs long since forgotten by the mother country. Their life is worthy a monograph, but it is the province of this paper to mention them only by way of illustration, and to call to mind the contrast between these "Blated Americans," their more fortunate brothers who pushed through to the prairies beyond, and the Indians driven from their hunters' paradise before the guns of the invading white.

The fate of the whites in the mountains was quite different from that of the whites with similar ancestry and attainments who pushed on towards the west. The response of the people to the environment was in part, no doubt, a matter of selection due to individual differences, the less enterprising permitting themselves to be pigeon-holed, so to speak, in the mountains. But the active and dominant constraining element was the physical circumstance of the land, and not the social status of the people. On the other hand, the same prairie land furnished a home, first for wandering tribes of Indian hunters, later for the agricultural and commercial white. In this case the potent differentiating elements must be sought, not in the land, but in the character and attainments of the people.

As an instance of another type of the selecting and differentiating influence of the environment, standing in marked contrast to the effect of the mountains upon our "Appalachian Highlanders," permit me to refer to the Balkans. Through the Ural gateway poured, in times past, horde after horde of "steppe riders," to use Mr.

Mackinder's felicitous phrase. Those taking the southern course, passing across the plains of Rumania, found their further advance hindered by the mountains. Many, finding themselves entrapped in the netwo k of hills, and unable to retreat because of the pressure in the rear, were brought face to face with what was to them an absolutely new and untried situation. The narrow, isolated forest-covered valley stood in sheer contrast to the free expanse of grass-covered, arid plains across which unknown generations of their ancestors had been wont to ride. The test was severe ; they had to meet the situation in some efficient way or die. The tamest and perhaps the most plastic, whatever that may mean, turned to the soil, and a measure of success has been achieved only after long struggle, much weeding out through death and desertion, and the falling into grievous and costly error. For not only were they called to a new service, but a sedentary life demanded a reorganization of the whole structure of the patriarchal life and all that the patriarchal status implied.

It was long before the heart of the nomad, hot with the love of change, could beat in harmony with the quiet and calm of settled life. The tamest responded first. Those unable to adjust themselves took to the free life of the mountains. With that slight sense of the rights of property or of individual responsibility which seems to be the peculiar inheritance of those living under steppe conditions and the patriarchal *régime*, they fell easily into the wandering life of the robber and the brigand, veritable prototypes of the robber barons of the Middle Ages, who possibly were the product of a similar process of geographical selection.

Stagnation has waited upon our Appalachian Americans, although they had the culture of Europe behind them. A whirlwind of change has been the fate of the horse-riders of Asia, held captive in the Balkan valleys. Surely the influence of the environment is profoundly modified by the social status of the population. The proposition is trite, but it is at least an open question whether geographers in their investigations live up to even the measure of light they have. If social geography is to be a science of distribution in fact as well as in theory, account must be taken, not only of the physical circumstances, but a large weight of emphasis must also be laid upon the social status of the group, because that status not only determines the character of the response, but the social situation is itself as real a factor of the environment as any of the organic or inorganic elements therein, and thus becomes one of the constraining elements in the field for investigation. Correspondence between these two great groups of phenomena, the physical circumstance and the social status, results in definite and, let us hope, predictable localization of social phenomena, and the following up of this programme, consistent, clear-cut, and worthy, is the task of social geography. An insight, therefore, into the culture, history, and psychical characteristics of the group is essential, if one hopes to be able to recognize the sequence and relative significance of those factors the resultant of whose influences shows itself as distribution in space of social phenomena.

In time past no lack of emphasis upon the influence of the physical environment is to be noted. Preparation for an insight into the problems of distribution, from this standpoint, has been provided for by well-directed studies in geology, physiography, meteorology, mineralogy, etc., and it is difficult to overestimate their value. If in the subject of social geography the social status of the group is found to have the significance suggested by this paper, however, then it seems reasonable to conclude that emphasis must be laid upon a broader and in some respects a very different grouping of sciences from that which custom has heretofore sanctioned. An insight into the mental characteristics of a group, and an appreciation of the probable course of their development, demand some knowledge of physiology, psychology, ethnology, and sociology, and a ready command of the methods, experimental, observational and statistical, by which scientific investigation is carried on. Without taking

into consideration these psychical and social factors, no adequate account of the localization of brigandage in the Balkans, for instance, can be attempted, for after all human activities are the outcome of human interests, and every concrete social situation is the expression of the part of the group of their attempt to do the best they can, under the circumstances, to satisfy their wants.

Due weight must also be given to the historical element, as was suggested by the illustration, in which attention was briefly directed towards the contrast in the development of agriculture in the Mississippi valley and in the Balkans. Those who attach weight to the advantages of an early start in the localization of industries make legitimate use of the historical element and are well within the limits of strictly geographical investigation, for it needs scarcely be noted that geographical factors are not necessarily facts of geography, *i.e.* facts of distribution. Broad preparation should therefore be made in the various aspects of history, cultural, political, economical, and institutional, by those looking towards the field of social geography as their lifework. The historian has long insisted upon the value of geography as a basis for his investigation. It is eminently fitting, and certainly high time, for the sake of social geography, that the compliment be returned, and as a sort of declaration of independence, demands might well be made upon history by the geographer.

As another essential feature in the preparation of the student of social geography, technology, including a knowledge of processes and appliances, and some insight into the course of their evolution, offers a rich and profitable field. The evolution and consequent distribution of the coal and iron industries is intimately bound up with the progress of discoveries and inventions in that field, and nothing short of definite and accurate knowledge of these is adequate if investigations along these lines are to have any weight of authority, or are to be of any value in the subsequent location of similar industries. And if the subject is not to attain this practical reference, it certainly falls far short of what it might and ought to be, and abandons one of its most potent claims for existence. This technical status of the social group is a most real and important factor in the localization of cities, commercial routes, and industrial centres. The progress of civilization from the potamic, through the thallassic to the marine stages has advanced *pari passu* with the evolution of transportation facilities. This does not imply that such evolution has been the sole cause of that migration of civilization. It illustrates crudely the fact that a knowledge of technical processes, and appliances, and their evolution is essential to an adequate understanding of the facts in the case.

The conclusion is brief. Without in any way suggesting an exhaustive analysis, one may say that, in addition to the physiographical group of factors which are by common consent held to be fundamental, the sociological factors are no less fundamental to social geography. And in this sociological group it seems especially necessary to emphasize the neglected fields of folk-psychology, culture-history, and technology, and to insist upon more adequate preparation in the various statistical, graphical, and comparative methods by which these subjects are best pursued.

Among the many effects of the give and take in the intricate network of interrelations between the physical circumstance and the social status, not the least interesting and informing is that of *localization*, and that complete survey of the factors which is the chosen task of social geography can be made only when the sequence and relative significance of the relevant phenomena from both fields, considered in their broadest aspects, are given due consideration. Of course no individual can have a detailed knowledge of so extensive a field. Here, as elsewhere, the element of relative values comes in, and one must be content to be faithful in a few things if he hopes to become master of many. Political-, economical-, or anthropo geography are worth the best effort of a lifetime, and demand nothing less.

RECENT GEOLOGICAL REPORTS FROM SOUTH AFRICA.

SINCE the last review of the geological reports in South Africa (see *Geographical Journal*, vol. **20**, p. 630) a number of valuable reports have appeared, the titles of which are noted at the end of the present notice. Two important works have also been published—Mr. A. W. Rogers' 'Geology of Cape Colony' (Longmans, 1905), and Messrs. Hatch & Corstorphine's 'Geology of South Africa' (Macmillan, 1905)—which summarize what is known in so clear a way that it is unnecessary for us to do more here than call attention to the more important points of geographical interest in the official reports.

CAPE COLONY.

In 1901 a new survey was made of the districts of Swellendam, Heidelberg, Riversdale, and Mossel Bay, by which a much clearer knowledge of the formation of the Enon conglomerates was obtained. It was found that this term had been too widely applied to all the rocks of the district, which included many members of the Uitenhage series, of which the Enon conglomerates properly form only the lowest division, and are to be distinguished from the overlying sandstones and plant-bearing shales known as the Zwartkop sandstones and Wood Beds. A considerable amount of work was also done in the Transkei and Kentani regions, when the Cretaceous and richly fossiliferous rocks of the "Umtamvuma Beds" were carefully investigated.

The work of the survey in 1902 was chiefly confined to the Matatiele district, on the eastern slopes of the Drakensbergen, a region largely composed of rocks of the Karroo system (Stormberg series). The chief interest of this survey lies in the information obtained of the volcanic rocks of these mountains. A whole series of volcanic necks were found along a north-easterly line, their position leading to the conclusion that the Drakensberg range was formerly a chain of volcanoes, whose activity began during the deposition of the Cave sandstones.

A revised classification of South African rocks is published in the Report for 1902.

An interesting problem in river development is afforded by the course of the Kenigha river in the Matatiele district. The general trend of the rivers here is towards the south-east, a direction followed by the Kenigha till it issues from the mountains, when it takes an abrupt turn and flows for 7 miles due west. Then meeting the Matabele river, which drains the next valley, it resumes a southerly direction. As the lower course of the Kenigha is known to be along the axis of an anticlyne, Mr. Schwarz thinks this disarrangement of the river system is due to the north and south folds which formed the arch, and which belong to the system of foldings prevailing in Natal.

In 1903 surveying was carried out in four different districts—

1. In Sutherland, Calvinia, and Ceres, completing the survey of the south-western part of the Karroo.

2. In the divisions of Prince Albert, Willowmore, and Uniondale, which was proved to be a very complex region, a period of earth-movements subsequent to the deposition of the Uitenhage beds has complicated the foldings made prior to that period in the whole belt south of the Karoo, and therefore the main structural lines are confused by an extraordinary number of minor folds. In the central Zwartbergen, for example, there is a zone of folds not arranged on a horizontal plane, as is usually the case, but on one more or less vertical.

Effective black and white maps on a large scale of both (1) and (2) are published with the report.

3. Van Rhyns Dorp, as far north as the Olifants river.

4. Tembuland, where the rocks met with include the entire thickness of the Stormberg system lying on a shallow bed of bright-coloured clays and mudstones, with bands of white sandstones which are classed provisionally with the Beaufort beds. The coal-measures in the Monteno beds at the base of the Stormberg series occur on two horizons—one below the Indwe sandstones, the other 150 feet above, separated by a fine-grained felspathic sandstone with mudstones. The seams that have been opened are, however, thin in both cases, and even should thicker and more continuous bands be found, transport difficulties would probably preclude any successful working of the coal.

In 1904 the examination of Van Rhyns Dorp was completed, and the whole district, with that of Clanwilliam and Piquetberg, mapped. The northern part is chiefly composed of granite, being the southern end of the great mass of igneous rock which covers so large an area in the north-west of the colony, while the south belongs to the Table mountain region, which flanks the folded belt west of the Karroo. The district is bounded on the east by the line of the Bokkeveld escarpment. Westward of this is a wide tract of flat country, dry and barren, especially in the north, where it can only be used for grazing in the winter months. In the southern end, where a little more rain falls, habitation is permanent, and a small amount of cultivation undertaken. Beyond this belt, again, is a great sandy tract reaching to the coast, divided from the flats in the north by the great granitic wedge of the Harde veld. With the granite are associated sedimentary rocks of the pre-Cape age, and amongst them was discovered a new series, known as the Nieuwerust beds. They form rather large hills, and are composed of arkose, quartzite, and slate; their correlation is as yet uncertain, but they are of later age than the Malmesbury beds or Ibiquas series.

The districts of Aliwal North, Herschell, and Barkley East were also surveyed and mapped, and it was found that, though the sedimentary rocks as a whole become more regular than in the southern part of the area of the Stormberg series, yet the coal-seams are thinner and of less value. In all the reports of the Cape Geological Commission, concise and valuable accounts of the configuration and general condition of the country traversed are given.

The Transvaal.

The work of the Geological Survey of the Transvaal in 1903 and 1904 covered the region between Pretoria and Nylstroom mainly eastwards of the railway line. The southern portion was traversed in 1903 from Hatherley to Balmoral. The sedimentary formations covering this area consist of the Pretoria and Waterberg series with a portion of the Karroo system (*i.e.* the sandstones, shales, and grits forming the coal-measures), and with these are associated considerable intrusions of igneous rocks. Near Wilge river Mr. Mellor discovered that the general south-easterly trend of the Pretoria beds is broken up, apparently by a big synclinal fold, and he notes that the volcanic intrusions in this series follow the bedding planes with remarkable persistency. The work done in this district has helped to complete the general knowledge of South African stratigraphy by proving definitely the unconformity between the Pretoria and Waterberg series, and showing that the red granite exposed at Balmoral is intrusive in, and therefore of later date than, the Waterberg formation. Further, an important discovery of glaciated land-surfaces was made near Balmoral, more northerly than those reported by Dr. Molengraaff in 1898.

A larger district was surveyed in 1904, a traverse being made from Pretoria

along the line to within a few miles of Pietersburg, and back by way of Chuniespoort and the Olifants, Eland, and Kameel rivers. The main object of this traverse was to obtain information as to the structure of the sedimentary rocks on the northern margin of the great igneous basins of the Bushveld and Springbok flats, and the relationships of these two formations. The horizontal sandstones which cover large areas on the flats, were found to be quite distinct from the typical Waterberg rocks, to which they were formerly considered to belong, and appear to be rather part of the Karroo system. Their relation to the amygdaloidal lavas of the flats is not, however, very clear, but the probability is that they are overlain by the amygdaloids.

Good evidence has also come to light of extensive volcanic action at or near the period of the deposition of the Waterberg sandstones, the coarse, fragmentary character of the conglomerates at the base of this system indicating that the period of sedimentation was ushered in by one of volcanic disturbance.

A survey was also made the same year of the district immediately south-east of Pretoria, where a complete inversion of the normal sequence of the Dolomite and Pretoria series was discovered, due to a thrust-plane which had forced the upper Dolomites on to the top of the lower shales of the younger series.

On the east of Elands river important evidence as to the relationship between the granite and felsites, and the felsites and Waterberg sandstone came to light. In some cases the granite was seen to be intrusive in the felsites, while the latter were found overlying the sandstones.

The geological results of the two years' work are embodied in two maps on the scale of 2½ miles to the inch, while the immediate surroundings of Pretoria have been mapped on a much larger scale—2 inches to the mile. The district includes considerable variety of country. The great belt of the Springbok flats, chiefly composed of amygdaloidal diabase, is an extremely shallow trough-like area, oval in shape, with its long axis running north-east to south-west, and the surface varied by broad and gentle undulations. Thorn-bush of a medium size covers a great part of the flats, but without undergrowth. The watercourses are ill-defined, usually taking the form of broad shallow depressions (laagte), and though large areas are suitable for cultivation if irrigation were possible, the prospects of obtaining flowing artesian water are not good. The sandstones of the flats are particularly close in texture and quartzite, presenting no very permeable beds to serve as a means of access to any considerable volume of water. From this region southwards the land rises gradually to the felsite plateau, beyond which is the line of high ground formed by the Waterberg sandstones and conglomerates to the west, while eastward lies a gentle topographical basin of red granite nearly surrounded by hills made up of the harder felsites. South of this again lies a region of sandstones and grits (Waterberg and Karroo series), and a line running by Rhenoster Kop (the one considerable elevation in this district) in a north-westerly to south-easterly direction, divides the two types of country—the Bushveld and the Highveld.

The region immediately south-west of Pretoria is composed partly of dolomite (about four-fifths of the surface mapped) in the north and east, and partly of granite (about one-fifth), giving two very distinct types of scenery. The upper portion of the dolomite area north of Hennops river, which has a large proportion of interstratified bands of chert, is an elevated country of somewhat rugged outline, while, where the lower beds of more uniform composition are exposed, the landscape is of a rolling type broken by occasional outcrops of igneous rocks, having a deep covering of the red soil so characteristic of dolomite areas. But passing to the granite country the superficial soil becomes sandy and yellowish, the land

being of a high and generally uniform level, though undulating with gentle hollows and grassy vleis.

The general slope of the district is from south to north, rising again in the hills south of Pretoria, and then falling rapidly to the town. North-west of Pretoria there is again the sudden division between Bushveld and Highveld seen farther east, the line marked by a belt of elevated ground running east and west from Waterval towards Hebron (about 4382 feet).

The diamondiferous area in the portion of the Transvaal surveyed during these years, is situated on the high ground which forms the divide between the Pienaars and Elands rivers, and is composed of the uppermost quartzites, shales, and sheets of diabase of the Pretoria series. The predominant rock amongst which the diamond pipes occur are quartzite, but vents are found in contact with diabase, as in the case of the Montrose pipe, or with felsite, as at the Premier pipe. Four pipes were being worked at the time of the survey, but since the mapping was completed a new vent has been discovered, though not yet geologically examined. No certain conclusion as to the age of the Transvaal pipes was arrived at, though they are evidently younger than the Pretoria series into which they are intruded, and, in the case of the Premier pipe, later than the Waterberg system. But without more direct local evidence, the correlation with diamond vents of the Kimberley area, though likely, considering the similarity in behaviour and constitution, cannot be definitely made.

NATAL.

The more important part of Mr. Anderson's work in 1901–2 was accomplished in Zululand, where he surveyed a considerable area, mapping the district immediately south and west of Melnoth on the scale of ½ inch to the mile. A traverse was also made in Natal from the high plateau at Pietermaritzburg *viâ* Richmond through the Umzinto district to the sea, and the region round Durban carefully examined.

Mr. Anderson makes two important correlations of Natal strata, identifying the Palæozoic sandstones with the Table mountain sandstones of Cape Colony, and the chocolate-coloured slates with quartzites and auriferous conglomerates which occur on the Umfolosi river with the Hospital hill series of the Transvaal. With the report published in 1904 a table classifying the Natal geological system and those of the Transvaal and Cape Colony is given, and a bibliography continuing that printed in the first report is included.

Mr. Anderson's conclusions as to the mineral prospects of the regions examined are not encouraging. Auriferous quartz reefs occur frequently amongst the older granites, gneisses, and schists of the colony both near Melnoth and in the Umzinto district, but they are not of sufficient persistence to be worth working. Nor are the coal-beds, which are here found in the upper Ecca sandstones, likely to be payable, owing to the irregularity in the deposition of this series. On the other hand, in the broad littoral of Zululand (50 miles wide in the north), where the soil is composed of alluvium influenced by the calcareous rocks beneath, Mr. Anderson holds we have a region which should prove of immense agricultural value for the growth of sugar, rice, and mealies, if put under irrigation. This should prove no great difficulty, for at the places where the rivers emerge from the hills on to the coastal plain the water could be stored for distribution over large tracts. It is not likely, however, that any quantity of artesian water will be found in any part of the colony, for although the necessary geological conditions (alternations of permeable and impermeable strata) are present, denudation has in most cases already tapped the sources of underground water-supply.

The district mapped round Melnoth is the highland forming the divide between the Umfolosi and Umhlatuzi rivers. Its northern part, composed of Table mountain sandstone with patches of Ecca (glacial) conglomerate, is plateau-like in character, while the south, a granitic and metamorphic region, has been carved into rugged hills and valleys which are very fertile. As in Natal, the Table mountain sandstones lie unconformably over the igneous rocks, and the Ecca conglomerate also rests unconformably on the sandstones.

Southern Rhodesia.

The plateau of Southern Rhodesia is composed of the oldest rocks (schistose) with large granite intrusions, the axis of its elevation running north-east and south-west, the line marked by the position of the chief towns, Bulawayo, Gwelo, Salisbury. The surface about the central portion near the divide is undulating and usually grassy, but as the land slopes away on either side, the rivers have cut deep valleys, and the scenery is more diversified, with more vegetation. The sandstone country to the north is very flat.

The Zambezi and Limpopo flow in synclinal valleys, and the course of the former has been deflected northwards by a second line of uplift, which raised the belt of high ground which runs parallel to the coast east of the central plateau.

The oldest rocks in Rhodesia are the Bulawayo schists, which are older than the associated granite, from which they dip away at a high angle, forming a series of synclinal folds. Lying unconformably over the schists and intrusive granites is a considerable thickness of sandstones, the lower beds containing seams of coal, probably of Permian age. These appear on either side of the main axis, and the beds are sufficiently thick to be of considerable economic importance. The sandstones above the coal-measures (forest sandstones) contain numerous lava-flows (generally basaltic and amygdaloidal), and bands of impure limestone and some nodules of chert. These Forest sandstones occupy most of the country north of a line joining Bulawayo and Gwelo and west of Mashonaland. The Victoria falls occur where the lavas interbedded with the sandstones have been thrown across the Zambezi, and along the course of the river below the falls of the Kariba gorge a continuous line of geysers and hot springs can be traced.

An interesting feature of the plateau is the presence of caves and swallow-holes, similar to those found in a limestone region, by which the rivers disappear into underground passages.

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GEOGRAPHY AND THE PUBLIC SERVICE.

A DISCUSSION has recently taken place in the *Times* which raises important issues of special interest to geographers. The discussion began by Sir George Goldie calling attention to an answer which Sir Edward Grey had given to a question in the House of Commons, in which he admitted that the subject of geography had not only ceased to be obligatory but was no longer one which a candidate for admission to the Diplomatic Service or the Foreign Office could even offer in the examination.

Mr. Mackinder pointed out that this was due to the abolition of the special examination for these services, and the selection of new officials from successful candidates in the examinations for Class I. of the Civil Service, in which geography could not be selected as a subject. He outlined the recognition which geography has now received from all the most important English universities, and pointed out the vast improvement in the teaching of geography in schools in recent years. He also insisted on the fact, too frequently forgotten, that "geography has its own modes of thought and its own points of view, which are not to be obtained in a hurry;" and that "the handling of geographical facts with power and care is as much a matter of training as the handling of historic or economic facts. The country requires men to meet the rapidly changing conditions of international competition who have not merely a general education, but special information and specially trained aptitudes."

Two different points were thus raised: (1) that candidates for appointments in the public service should be required to show special knowledge and aptitude in subjects of practical importance in the work of the office selected, and that geography was such a subject for several offices; and (2) that geography was now so recognized and taught in our schools and universities as to justify its admission to the Civil Service Class I. examinations.

(1) The first point has been shirked by the Civil Service Commissioners in their replies, it being assumed that a good general education is sufficient. Mr. Courthope, indeed, stated that the rule of the Civil Service Commission was to consider this alone and to make their examinations as far as possible fit in with the undergraduate work in the various honours schools of our universities. Prof. Firth pointed out that the examination for the Indian Civil Service (which has now been extended to candidates for First Division clerkships in other branches of the Civil Service) was on quite a different footing from that for other offices, as a post-graduate course of one year was taken by all I.C.S. probationers, during which special training was given for the work in India. Yet the position now is that so clearly put by Prof. Firth: "At the present moment, thanks to the exertions of the Geographical Association, it (geography) is beginning to be properly taught in our schools, while, thanks to the liberality of the Royal Geographical Society, it is beginning to be scientifically studied in our universities. As long as the subject was badly taught in schools, and not studied at all in our universities, it was an obligatory subject in the examination for the Foreign Office. But as soon as its teaching shows signs of becoming efficient it is to be excluded from the examination altogether."

(2) Both Prof. Firth and Mr. Mackinder pointed out that geography and economics practically had the same academic recognition in Oxford, yet the former was not accepted by the Civil Service Commissioners, while the latter was a special subject receiving 600 marks in Class I. examination. They also replied to Mr. Courthope's contention that the Commissioners could not use the public examinations as an instrument for determining the course of education at the universities,

by stating that this was exactly what the Commissioners were doing by refusing to admit a subject duly recognized by the universities.

This led to a second letter from Mr. Courthope, in which he stated that the entire scheme of Class I. examination was discussed, revised, and the marks re-adjusted after a conference with representatives from all British universities, and that no claim for geography as a special subject of examination was made. Were the universities ever officially asked what subjects should and what should not be included in this examination?

At the end of this letter the chairman of the Commissioners stated that "there was nothing to prevent the list of subjects being extended," but that they declined "to add any subject to the list before they received an application to do so from the authorities who regulate the studies of each university as a whole, as well as from the advocates of the particular study."

It is for the Public Departments and the Universities to act next.

REVIEWS.

ASIA.

Persian History.

'Persia, Past and Present.' By A. V. Williams Jackson. *With Illustrations.* New York and London: Macmillan. 1906. *Price* 17*s. net.*

Prof. Jackson's work, as its title shows, is mainly historical. It deals in a most comprehensive fashion with the Achæmenian and Sasanian inscriptions and rock sculptures, in which Persia is so rich, and proves yet once again how important it is for the student to travel and for the traveller to study.

Prof. Jackson's most important task consisted in re-examining the Behistun inscriptions, which are so intimately connected with the late Sir Henry Rawlinson, and it is of extreme interest to read what difficulties had to be surmounted by that truly great frontier officer, and what labour and patience were involved before the annals of Darius were rescued from oblivion. Prof. Jackson is also an enthusiastic student of the Avesta, and it is of considerable value to follow his numerous identifications of the various localities connected with that great prophet.

In conclusion, for a complete knowledge of Persia this work is indispensable, and it is worth while to note how rapidly materials are being collected which place the present generation in a favourable position for studying the history of Persia. This task has not been attempted as a whole since Sir John Malcolm essayed it nearly a hundred years ago, but when the secrets of Susa are completely published, only the historian will be needed to crown the task.

P. M. S.

The Exploration of Tibet.

'Tibet the Mysterious.' By Colonel Sir T. H. Holdich. ("The Story of Exploration." Edited by Dr. J. Scott Keltie.) London: Alston Rivers. 1906. *Price* 7*s.* 6*d. net.*

The latest volume of the "Story of Exploration" series, edited by Dr. J. Scott Keltie, is by the pen of Sir Thomas Holdich, and deals with "Tibet the Mysterious." No more interesting record of geographical discovery than that of Tibet can well be imagined, and it would be hard to find a writer capable of doing better justice to it than Sir Thomas Holdich. Students of Asiatic geography will remember how, up to some two years ago, our knowledge of Tibet was due almost entirely to what one may term the "exploring adventurer"—that is to say, to the

men who were prepared to run grave risks and to encounter numerous hardships in their quest for information; and that in the ranks of these daring travellers are found not only Europeans, but also many of the native employées of the Survey of India. The expedition to Lhasa in 1903–4 laid open a considerable area of the most important part of Tibet to scientific examination and mapping, but even now by far the larger part of the country is known to us through the efforts of the earlier pioneers.

Sir Thomas Holdich, then, confines himself chiefly to a narrative of the adventures and accomplishments of the explorers proper, and he gives us a brief *resumé* of the journeys of all the most important of them. Beginning with Friar Odoric of Portenone in 1328, he traces the history of the exploration of Tibet right through to Rawling and Ryder in 1904; and incidentally he tells us the romantic story of missionary enterprise in Tibet during the eighteenth century, and how the Capuchins and Jesuits strove for premier place at Lhasa.

The earlier chapters of the book deal with Tibet in its more general aspects. Here we find descriptions of the country as a whole, and of the various routes leading into it, and a very interesting sketch of Tibetan history; and the last chapter deals with political and commercial relations. During the course of the work Sir Thomas Holdich frequently calls attention to the desirability of improving existing lines of communication between India and Tibet, and emphasizes the potential value of a line up the valley of the Brahmaputra from Assam. He also points out the importance of South-Eastern Tibet as a possible centre of trade if linked with India and China by way of Rima and Batang. But it is safe to say that until the most important part of Tibet—that is to say, the central portion, where are situated Lhasa, Shigatse, Gyantse, and all the great monasteries—is linked to India by a suitable cart-road, it is unlikely that any improvements will be made in the communications further east and west. Lhasa, after all, is the political and commercial centre of the country, and it was to checkmate foreign intrigues at Lhasa, and to bring the Lhasan authorities to their senses, that the late mission was undertaken. Obviously, that part of Tibet must first be opened to our influence and our commerce before we begin to construct fresh roads elsewhere.

Sir Thomas Holdich's book contains a very great deal of most valuable information, but if a small criticism may be directed to his method of conveying it, it is that the arrangement throughout is not systematic. Facts are produced in a somewhat haphazard manner, and the long tale of exploration becomes in places rather tangled and bewildering. Amongst omissions may be noted the names of the Abbé Krick, Abbé Desgodins, Mrs. E. C. Ryall, and several of the native explorers, and an imperfect account is given of Prjevalsky's four journeys.

BALTISTAN AND LADAKH.

'A Summer Ride through Western Tibet.' By Jane E. Duncan. *Illustrations and Map.* London: Smith, Elder. 1906. *Price* 14*s. net.*

Miss Duncan did not enter Tibet at all, and only reached Lukong "within 20 miles of the frontier," as she says; yet the title is not very misleading, for her travels were in those parts of Kashmir, known as Baltistan and Ladakh, where the people are Tibetan in race and language, thus differing from the inhabitants of other portions of the Maharajah's territory; and the Ladakhis further differ by being Buddhists, while the country traversed is a westward continuation of the Tibetan uplands, though more rugged in character, and dissected by the Indus and its tributaries. No new ground was covered, and the traveller followed beaten tracks between the giants of the Karakorams and Himalayas, under the guidance of an

"Admirable Crichton" in the person of one Aziz Khan. As a descriptive account of a ride in the less-known parts of Kashmir, the book is interesting enough, and the excellent photographs, mostly taken by the author, add a value to her work.

Miss Duncan started from the vale of Kashmir from Srinagar. Her route was up the valley of the Sind and over the three passes, Zoji La, Namika La, and Fotu La, into Ladakh. At Lamayuru, one of the numerous monasteries that abound in Ladakh was visited, and inspection made of its treasures, which included rows of praying-wheels, books of the Buddhist scriptures, and frescoes of scenes from the life of Buddha. To see the Devil Dance, which is performed annually by masked lamas at Himis, near Leh, where there is a large monastery at an altitude of about 14,000 feet, was one of the objects of the author's journey, and she gives an interesting account of it. While in Ladakh she witnessed Tibetan wedding festivities and a Tibetan funeral, and attended several *tamashas* (festivals). She reached her nearest point to Tibet by crossing the Chang La (nearly 18,000 feet), but she experienced no ill effects from the altitude, feeling only exhilaration. After retracing her steps to Khalatse, she entered a region unknown to white women till that summer (1904), then, crossing the Chorbat La, she left behind Lamaism and entered the country of the Baltis, who, though Tibetan in race and language, are quite independent of the lamas, for they are Mohammedans. She stayed at Khapallu for about a month for a great *tamasha* celebrated but once in thirty-six years (the next in 1940), which no European had previously witnessed. The festival lasted for two days, and comprised a series of dances, processions, polo-matches, and general jubilation. Hereabouts she attained no little reputation as a medicine woman.

Several photographs of Buddhistic inscriptions and rock-carvings are given, some from Balu-rukhar, and others from Sadpor. These (which had not previously been recorded) are translated by the Rev. A. H. Francke, who has also harmonized some Tibetan music, specimens of which are given.

Miss Duncan claims not to be scientific, so she must be excused for referring to what from her description are river terraces as "glacial moraines."

AFRICA.

Abyssinia.

'Abyssinia of To-day. An Account of the First Mission sent by the American Government to the Court of the King of Kings (1903–1904).' By Robert P. Skinner. London: Edward Arnold. 1906. *Price* 12*s*. 6*d*. *net*.

Mr. Skinner's record of his visit to the capital of Abyssinia in December, 1903, is eminently readable; none the less so for the touch of self-satisfaction, which is as characteristic of the American as the Briton. The American mission followed the beaten track from Jibuti to Adis Ababa, and did its business—the conclusion of a commercial treaty between the United States and Ethiopia—in record time. Though barely three months in the country, Mr. Skinner made good use of his opportunities. His notes on the treatment of natives, on camp equipment, and on trade and economic developments, are all marked by strong common sense. As in the case of every thoughtful visitor to Abyssinia, the history of this native Christian state, its social organization, and the racial affinities of the people, excited the interest of the American Commissioner, and his object in writing has been as much to give his fellow-citizens some elementary information about "Ethiopia" as to chronicle the doings of the mission. Mr. Skinner is not always a safe guide when dealing with matters not within his personal knowledge, and to British readers the book will be valuable chiefly as enabling them to study Abyssinian questions through American

spectacles. It does not in any way supersede Mr. A. B. Wylde's 'Modern Abyssinia.' Mr. Skinner notes the predominance of the French among the Europeans in Menelik's dominions; perhaps this fact has led him to use the French spellings of names of places and persons, *e.g.* Choa, Djibouti, Ras Oualdo Gorghis. The book has over thirty illustrations and a useful sketch-map.

Travels in East Central Africa.

'Mission Scientifique du Bourg de Bozas. De la mer Rouge à l'Atlantique à travers l'Afrique tropicale. Carnets de Route.' Paris: F. R. de Rudeval. 1906.

In this handsome volume M. Fernand Maurette narrates the doings of the du Bourg de Bozas mission from its arrival at Jibuti in January, 1901, to its departure from Matadi in February, 1903. Fired by the achievements of other French travellers, the Vicomte Robert du Bourg de Bozas determined to lead an expedition into Africa, chosing the east central part of the continent as the field of his labours. Aware that the days of "les grands raids à travers le blanc de la carte" were gone for ever, he adopted the scientific method of thoroughly examining limited areas from fixed points. In this manner the regions between Harrar and the north end of Lake Rudolf were explored, while from the lake a route was taken to the Nile at Nimulé. The main achievements of the mission have been chronicled in the *Journal*, and need not be repeated here. On the return to Europe by way of the Congo Free State, du Bourg died of fever at a station on the Welle on Christmas Eve, 1902. Young, energetic, capable, with time and means to devote to the cause he had espoused, his premature death is greatly to be regretted. The volume before us is a worthy memorial of an excellent piece of work. M. Maurette has constructed his text from the journals kept by Robert du Bourg, the story of his illness and death being transcribed from the diary of one of his colleagues. The result is admirable—the narrative is easy and seductive, with just that touch of hero-worship which befits the occasion. The physical features, economic *régime*, and manners and customs of the peoples throughout the country traversed, are the chief subjects dealt with—the text being illustrated by nearly two hundred finely reproduced photographs. There are also shrewd criticisms and appreciations of the Abyssinians, of British colonial methods, and such-like matters. With the British officials met in Uganda, du Bourg and his comrades were on excellent terms, as also with most of the Congo State officials encountered. On the methods of administration adopted by that state there is some very caustic comment, the more biting because of the marked restraint of the language used. From the point of view of geographical research, a protest might legitimately be made against the prohibition placed on the mission to cross the territory of the state except along a route marked out beforehand by the Congo officials. Thus from the moment of entering the state the mission was able to accomplish little original work.

M. du Bourg's European colleagues—all, like their leader, men under thirty—were Dr. E. Brumpt, Lieut. J. Burthe d'Annelet, M. de Zeltner, M. Golliez, and M. Didier. The results of their investigations into the geology, botany, zoology, ethnography, pathology, and parasitology of the countries explored by the mission are to be published separately; from the indications in this volume, there should be much of value to tell. The route of the mission is traced on three maps drawn by J. Hansen on the scale of 1 centimetre for 20 kilometres. The astronomical position of thirty-eight stations, as determined by M. Golliez, are tabulated. For frontispiece there is a photogravure of M. du Bourg. In a commendatory and explanatory preface M. R. de Saint-Arroman falls into a double mistake; he speaks of Dr. Donaldson Smith as an Englishman, and disguises Major Swayne as "Sivayne." This curious variant is probably a printer's error, as in the same line Bòttego is given as Bòtlego. F. R. C.

African Geology.

'Notes on the Geology of the Continent of Africa.' Compiled in the Department of the General Staff, War Office, by Alexander Knox, B.A., map curator. 1905.

These notes are prefaced by a short and exceedingly lucid article on the dependence of geography as a science on geology, which "supplies the unerring answer to almost every geographical question," and the importance of the study of both, especially from the strategic point of view.

The geological history and present geological conditions of the continent are carefully summarized from the best authorities, and a geographical description given of each of the four regions, east, west, north, south-central, with South Africa. The third section of the book consists of detached notes concerning the composition of the rocks in many parts, with reference to an index map; but, as it is pointed out, only in the extreme north and extreme south of Africa can a systematic survey be carried out, owing to the lack of precise topographical maps. Detailed references are given to all the works consulted, and a fairly full bibliography of the subject completes the volume.

AMERICA.

Mexico.

'Das heutige Mexiko und seine Kulturfortschritte.' By Paul George. Jena: G. Fischer. 1906.

This is an interesting pamphlet on modern Mexico and its social and economic development. The author points out that the development of Mexico is closely connected with the education of the mixed races who form nearly half the population. Unfortunately, though they develop rapidly up to a certain age, they seem to lack mental stamina, and have left the industrial progress of the country largely in the hands of foreigners. An interesting parallel is presented by the conditions with which we are familiar in India at the present time.

An account is given of the efforts which are being made by technical education to get the native-born Mexicans to take the place in the development of the land for which their adaptation to the climate renders them essential. The physical conditions of Mexico, which are briefly sketched, show how considerable the area is which can only be opened up by a native race. Among the statistics of population which are quoted, one item is especially noticeable. In 1900 there were 155,574 illegitimate births out of a total of 470,060.

An instructive table is given of the area and population of Mexico as compared with the principal countries of the world, in which it will be seen that the population (1900) was a little less than that of Brazil (1890) with less than a quarter of the area.

The industrial progress of Mexico is shown by the increased value of imports, among which machinery and the material for manufactures figure prominently, and also by the great advance made in communication by railways, posts, and telegraphs. The pamphlet concludes with a number of excellent views of the antiquities and history of Mexico. A. W. A.

POLAR REGIONS.

The Cruise of the "Scotia."

'The Voyage of the *Scotia*: being the Record of a Voyage of Exploration in Antarctic Seas by Three of the Staff.' *With Illustrations.* London and Edinburgh: Wm. Blackwood & Sons. 1906.

This volume may be taken as the authentic narrative of the Scottish Antarctic Expedition, which was organized by Mr. W. S. Bruce, and financed mainly by

Mr. James Coats, junr., and Major Andrew Coats, with the co-operation of other unnamed Scotsmen. Mr. Bruce contributes a prefatory note, in which he vouches for the faithfulness of the narrative and the staunch support given him by the three authors, Mr. R. C. Mossman, Dr. J. H. Harvey Pirie, and Mr. R. N. Rudmose Brown. We view the volume as a very valuable addition to our knowledge of the Antarctic regions, and only regret the absence of a chapter by Mr. Bruce himself on the oceanographical work, and a chapter on the ice-navigation by Captain Thomas Robertson, whose experience is absolutely unique amongst Antarctic explorers, and whose handling of the *Scotia* was worthy of the fine traditions of the merchant skippers who led the way in those seas—Smith, Powell, Weddel, Biscoe, and Balleny. We miss also any details as to the cost of the expedition, which would, we believe, have been interesting in showing that good results do not necessarily involve great expenditure; but we recognize that in a private expedition the leader is the sole judge of what requires to be published.

The expedition described in this volume was one of which the leader, the scientific staff, the captain and officers of the ship, and the subscribers to the funds may all be justly proud.

The book abounds in incidents of the usual kind, told rather better than usual—the humours of the crew, the rigours of the season, the perpetual fight with weather and ice, the quaint habits of penguins and seals; and all these are introduced judiciously, and not dwelt upon unduly. The main interest throughout is scientific, and the serious purpose of the expedition in advancing science is never lost sight of.

The *Scotia* left the Clyde on November 2, 1902, reached Port Stanley on January 6, 1903, and sailed again on the 26th, a month after the southern midsummer. Arrangements were made for meteorological observations to be carried on at the Falklands for comparison with those made further south. The ship got amongst icebergs on the 30th, in 56° 25′ S. lat., and reached the edge of the pack in 60° 28′ S., 43° 40′ W., on February 3, considerably farther to the north than it had been found in the same longitude by earlier explorers. Retiring northward, Mr. Bruce paid a visit to Saddle island, one of the South Orkneys on which no landing is recorded since Dumont d'Urville was there in 1838. The ship then held eastward along the pack nearly in latitude 60°, and on February 14 the edge was rounded and a southerly course resumed. The Antarctic circle was crossed on the 18th, and on the 22nd the latitude of 70° 25′ was reached in 17° 12′ W. It was impossible to get further south on this occasion; but until the sea began to freeze round the ship, she was kept at work sounding and collecting specimens in a part of the ocean in which work of the kind had never been carried on before. On March 25, 1903, the ship, after much buffeting and some damage, was anchored for the winter in Scotia bay, on the south side of Laurie island in the South Orkneys.

The second part of the work of the expedition lay in Laurie island, although after the wintering the ship had to make a long trip into the temperate zone and visit Buenos Aires, in order to communicate with home on economic matters. A solid stone hut was erected on the beach near the anchorage, stores were landed, meteorological and magnetic observatories set up, a survey of the island undertaken, and collections made of natural history and geological specimens. Under the experienced direction of Mr. Mossman, the meteorological observations throughout the winter were of high accuracy and great value, though kite observations failed. When the ship left on November 27, 1903, Mr. Mossman remained on the island, in company with Dr. Pirie and four others, to keep the work going. On February 15, 1904, the *Scotia* returned, bringing a party of Argentine meteorologists to carry on the station for a second winter, at the cost of the Government of the Argentine Republic. Mr. Mossman continued in charge of the observations for a second year,

bidding farewell to his comrades on the *Scotia*, and, returning to civilization after a second winter by the Argentine gunboat, sent for the relief of the party a year later. He did not leave Laurie island, however, until he saw it regularly occupied as a permanent meteorological station by that most enterprising of South American countries, and it is now, we understand, manned by a staff of observers trained in the Ben Nevis Observatory, who, since the closing of that building, have taken service with the Argentine Meteorological Office.

On February 22, 1904, the *Scotia* left Laurie island for the south on her second Antarctic cruise. Pack-ice was first met with on the Antarctic circle in 32° W. long. On March 2, when in 72° 18′ S., 17° 59′ W., the ship was stopped by the pack, and land was reported ahead. The depth was 131 fathoms; previously it had been over 2500 for some time. There was a lofty ice-barrier in sight, but this could not be approached within 2 miles on account of the pack. "Birds were abundant, and some grampus were seen playing in the open water. Large bergs were numerous, and one small piece of banded berg-ice was noted, studded with rock-fragments, but it proved impossible to geologize on account of the brash-ice surrounding it."

By the 6th the barrier had been traced to a point 150 miles south-west of where it was first observed. The surface of the ice beyond the barrier "seemed to rise up very gradually in undulating slopes, and faded away in height and distance into the sky, though in one place there appeared to be the outline of distant hills; if so, they were entirely ice-covered, no naked rock being visible." Pack-ice made it impossible for the ship to come up to the wall of ice; but a sounding of 159 fathoms 2½ miles off the barrier satisfied the explorers that they had discovered a new land, which was named Coats Land, after the two largest contributors to the cost of the expedition. Abundant proof of the proximity of land was furnished by the dredge, which brought up boulders of granite, schist, gneiss, quartzite, sandstone, slate, and limestone—all rocks characteristic of continental land. On March 9, the furthest south point was reached in a bight of the Coats Land ice-barrier, where the position was 74° 1′ S. and 22° 0′ W. Here the ship was beset in the pack, and for a time it seemed improbable that she could be extricated before winter sealed her up for the best part of a year. On the 13th the pack slackened, the *Scotia*, which had been lifted on the ice, slipped back into her proper element, and on March 14, 1904, she had got clear.

During the whole voyage frequent soundings had been taken, and the submarine configuration was felt out in greater detail than in any other expedition. As she pursued her way northward, the ship stopped on the position of Ross's famous sounding of 4000 fathoms with no bottom in 68° 32′ S., 12° 49′ W., and an excellent cast of the lead was obtained, bringing up a sample of blue mud and fixing the depth as 2660 fathoms. There seems to be no doubt, from the length of line paid out with the dredge and trawl, which failed to reach the bottom in no very excessive depths, that that part of Weddell sea is affected by strong undercurrents, which, acting on the comparatively large surface of Ross's hemp-line, could easily have kept the weight he used from sinking to the bottom. Many authorities questioned the accuracy of Ross's deep soundings, and did not show them on bathymetrical charts, but Sir John Murray believed that this particular sounding was more likely to have been right than wrong, and his chart of the submarine forms of the Southern ocean south of the Atlantic has been greatly altered by the new measurement.

On April 3 in 56° 55′ S., the blue muds of continental origin, which covered the ocean-floor all the way northward from the ice-barrier, gave place suddenly to diatom ooze, a purely pelagic deposit. Very severe weather was encountered, and the ship

received some damage from heavy seas; in fact, one of the authors observed that if the old navigators had tried to make more southerly courses we would have heard more of the "furious fifties" than of the "roaring forties."

An interesting episode of the homeward voyage was a visit to Gough island, an outlying member of the Tristan d'Acunha group set in the wide ocean 1500 miles from the Cape of Good Hope and 2000 miles from Cape Horn. This island had never been visited before by men of science, and a landing was made with extreme difficulty and at no little risk. The remains of sealers' huts were found on the island, and during the one day which the scientific staff of the *Scotia* spent on shore they made large zoological and botanical collections, though apparently it was not possible to study the geology so fully on account of the difficulty of getting about. From this point the expedition made its way direct to Capetown, only stopping to sound and trawl in the deep water of the South Atlantic several degrees to the south of the track of the *Challenger*. Capetown was reached on May 5, left on the 21st, and on July 21, 1904, the *Scotia* returned in triumph to the Clyde.

The part of the work of which as yet we are best able to judge is the large series of deep-sea soundings, upon which Mr. Bruce has based a new chart of the depths of the South Atlantic, published in the book. His work goes far to fill the gap between the soundings of the *Valdivia* and of the *Belgica*. The deep water of the Pacific coming round Cape Horn is shown as shut in by a ridge, in most places within 1000 fathoms of the surface and probably everywhere within 1500 fathoms, running eastward from Louis Philippe Land and the South Shetlands through the South Orkneys and the Sandwich Group to South Georgia, whence it is probably continued westward again to the Falklands. Depths under 2000 fathoms seem to prolong this ridge eastward through Bouvet island, thus cutting off the deep water of the eastern and western Atlantic basins from the Antarctic Deep. Mr. Bruce sketches a hypothetical boundary of the Antarctic continent, his suggested coast-line running south-westerly from Enderby Land to south of 70° S., and touching 75° S. immediately to the west of Coats Land. He accepts Morrell's longitude for the land reported in 1823, which we believe to have been the east side of Graham Land—an error of 15° in longitude, where degrees are so short as in 70° S., being quite possible in the case of a small sealing-vessel eighty years ago. To us the great peninsula suggested to the east of Graham Land appears unnecessary, and its adoption involves an ungainly crowding and bending of the contour-lines of depth, not required by any of the soundings which are charted. So far as it is worth while to speculate on what is quite unknown, our sense of the probable would have been gratified by sketching the hypothetical coast-line in a graceful sweep from Coats Land to Larsen's farthest position of 1893.

H. R. M.

GENERAL.

History of Geography.

'The Dawn of Modern Geography.' Vol. iii. By C. Raymond Beazley. Oxford: Clarendon Press. 1906. *With numerous Facsimiles. Price 20s. net.*

In the presidential address recently read by the President of the Royal Geographical Society before the British Association at York, reference was made to the increasingly important position which is being assigned to geography at our universities and schools. Many among us indeed believe that history should not be written or taught without a study of geography, and such views undoubtedly receive fresh confirmation of the strongest character by the recent publication of the third volume of 'The Dawn of Modern Geography,' in which Mr. Beazley has delineated with a masterly hand the birth of that science in medieval times. Those who study

this work carefully can hardly fail to form the opinion that not only should it be read by aspiring historians, but that it is itself history, written on such broad lines and with such clear combinations of cause and effect that the result is to dwarf any writer who would neglect this aspect of the subject.

In his previous volumes, Mr. Beazley has shown us how, until about A.D. 1000, the East was greater in almost all that makes for true greatness than the West. A little later, and Christendom was revitalized by the pagan Norsemen, who, like all converts, were full of zeal. Indeed, they formed the steel tip of the lance with which Latin Europe, in the form of the Crusades, attacked Islam; and Islam, too, it is of interest to note, was also revitalized at about the same period by the hardy Seljuk horsemen, who confronted the sea-rovers of Europe with success.

The volume commences at a period when the Crusading movement had failed; but the widening of the geographical and, consequently, of the general outlook of Europe had been so great that the seed sown in failure was destined ultimately to bear a crop such as the world has never seen. It was owing to the Crusades that the East and its riches emerged from the realm of myth and became a fact. Pilgrims, at first, travelled with singularly small profit to the world, intent on visiting holy places, and heeding nothing else; but, little by little, alert inquirers found means to explore the chief centres of Asia, and, when the Crusades were abandoned, commerce had succeeded to pious contemplation. Again, the development of sea transport, which the maintenance of the Crusaders in Palestine had fostered, led to its ultimate, uncontested victory over land transport.

The period, however, opens with the greatest land-journeys ever recorded, when Marco Polo and his uncles undertake their marvellous explorations, and it is extremely interesting to follow them under Mr. Beazley's able guidance, more especially in view of the recently published third edition of Yule's great work by that able French savant, M. Henri Cordier. One point in which the reviewer differed both from Sir Henry Yule and M. Cordier was that he could not believe that the illustrious Venetian actually visited Baghdad; * but he maintained that he entered Persia near Tabríz, and travelled *via* Sultánia, Kashán, and Yezd to Kermán and the Persian gulf. It is of importance to note that Mr. Beazley, too, is unable to accept the Baghdad theory, which he considers to be untenable.

To resume, we are given a most lucid summary of Marco's travels across Persia and Central Asia to China, and thence we follow our hero to Java, Ceylon, India, and home again *via* Tabríz and Trebizond; and we are shown what an enormous influence these explorations exerted on the thinkers and men of action of Europe both at the time, but still more at a later period.

The successors of the Polos were friars, the most famous of whom was John of Monte Corvino. To him belongs the honour of first preaching Roman, as apart from Nestorian, Christianity in the Deccan and in China. The effect of this activity on commerce was soon apparent, as but thirty years after the departure of the Polos, and two centuries before the discovery of China by sea, we hear of a Genoese factory established at Fokien. Surely this is fit to rank among the most marvellous achievements of commerce!

Following on the tracks of the Far-Eastern Mission, we are shown the Persian Mission, the headquarters of which was at Tabríz, although there was an archbishop of Sultánia. A brief account is given of the correspondence which took place between Arghun Khán, the Mongol ruler of Persia, on the one hand, and the Pope, Philip IV. of France, and Edward I. of England on the other. In it we have proof that attempts were being made many centuries ago to bridge over the gulf which

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* *Vide* "Did Marco Polo visit Baghdad?" in *J.R.G.S.* for October, 1905.

separates the East from the West; perhaps, too, we feel proud that England was known and respected in distant Iran in the thirteenth century. As time goes by, the penetration of Asia by Europeans becomes more and more difficult, until, with the death of dread Tamerlane, thick darkness again settles down on Asia, and Christendom is driven perforce to seek for a sea route to the East, access to which by land is denied.

To Genoa belongs the immortal honour of leading Europe along the difficult route of oceanic advance. Not only was that great maritime state itself privileged to equip the earliest expedition, which was despatched to rediscover the Canaries at a time when the Polos were engaged on their great land enterprises, but, by training a navy for Portugal at the beginning of the fourteenth century, even more was accomplished. Ultimately, Portugal led Christendom round Africa to the East, and thereby gained imperishable fame for all time. Her heroic efforts culminated in the severance of the great trade arteries connecting India and Islam, and, by diverting the commerce in spices direct to Europe, reduced the wealth and, *pari passu*, the power of the Mohamedan world so radically that Europe was freed once for all from the fear of Asiatic dominion.

To conclude, we have to thank Mr. Beazley for three volumes which will constitute the standard work for Europe on this extremely important subject, and we may also express the hope that this is not the last volume which the writer will produce on these bed-rock lines of deep research.

P. M. S.

THE MONTHLY RECORD.

EUROPE.

The Plateau of Aubrac, Central France.—Twenty-two miles south of the Plomb du Cantal, the Truyère, issuing from the mountains of the Margeride, bounds by a narrow gorge a little-known region of pasturage, lonely but rich in verdure and flocks. It is the district of Aubrac, an elliptical plateau 35 miles long and 25 miles broad, forming part of the southern highland of Central France. An instructive outline of the geography of this plateau is given in the August number of *La Géographie*, 1906. The structure of the plateau is granitic, with basaltic flows in the middle districts. The mean altitude is about 1300 metres (4250 feet). The surface is everywhere covered with a layer of humus from 80 to 100 centimetres in thickness (32 to 40 inches). This is due to the forests which formerly covered the region. In the east the pasturages on stretches of lava-deposit are most extensive, while in the west the country is thickly forested. Volcanic remains, such as craters, have been worn away by subsequent glacial action, while deep valleys have been similarly eroded in the crystalline schists. At the southern base of the plateau is a belt of Jurassic limestone. The climate is naturally severe, and may be regarded as continental. Vegetation does not begin to grow before May, while snow has been known to fall in June. The rainfall is considerable, being from 100 to 140 centimetres (40 to 45 inches) a year. The winds, which often blow with violence from the north, bring blizzards, and put a stop to traffic. Fogs are frequent, but, owing to the dryness of the air, dew and hoar-frost are rare. The absolute humidity is lower than that of the plain; the relative humidity varies from 51 per cent. in March to 88 per cent. in January. There are 170 days of absolute insolation, and 195 days on which rain or snow falls. The barometer varies from 628 to 670 millimetres (24·7 inches to 26·3 inches). The annual mean temperature is about 9° C. (48·2° Fahr.); in winter the

mean is 0° C. (32° Fahr.); in summer, 18° C. (64° Fahr.). The lack of cultivation hinders the absorption of heat by the soil. Wildfowl, such as duck, snipe, and widgeon haunt the streams, which rise from numerous springs. Foxes and boars still exist, but no wolves have been seen since 1880. The flora is characteristic of these latitudes (45° N.), and includes—*Anemone montana, Aconitum vulgare, Cardamine amara, Viola luteola, Viola gracilis, Dianthus monspessulanus, Saxifraga stellaris*, etc. Of the forest trees the beech occupies 90 per cent. of the surface between the line of 500 metres (1550 feet) and the limit of the pasturage. The horse-chestnut does not appear above 750 metres (2400 feet); the oak occurs only below 700 metres (2250 feet). On the plateau stunted growths and clearings still bear witness to the ravages of the Hundred Years' War, and to the abuses of exploitation by the villagers. The forest was bestowed on a hospital founded by Abelard of Flanders, 1120; but since the Revolution it has been under the central authority. Thanks to the lightness of the soil, to the continuance of snow during the long winter months, and to the remarkable duration and intensity of the insolation, the region of Aubrac is marvellously adapted to pastoral cultivation. The seasonal migration of sheep no longer exists, but more than 14,000 cattle spend the summer on the pastures, which number 350; during the winter they are stabled in the valleys. The chief industry of the inhabitants, who are grouped in the villages of Laguiole, Géneviève, Nasbinals, and Aubrac, is that of cheese-making. Every year 900,000 kilogrammes are made, valued at 960,000 francs (£38,400). They are exported chiefly to the southern departments and to Algiers. There is also a flourishing health resort at Nasbinals, to which flock the neighbouring towns-people to take the air, and to drink the *petit lait*, or whey. The inhabitants themselves are mountaineers of fine physique, but of quarrelsome temperament.

The Alps as a Weather-parting.—The meteorological studies at stations on alpine heights—especially those relating to the nature of the Föhn—have led to a more precise determination of the part played by the Alps as a dividing-line in regard to the temperature of the European continent. In his "Transport kalter Luftmassen über die Zentralalpen," in the eightieth volume of the *Denkschuften der Math. Naturw. Klasse der Kaiserl. Akademie d. Wissenschaften in Wien*, 1906, Heinz von Ficker, assistant at the Central Institute for Meteorology and Geodynamics in Vienna, sums up the question in the following words: "The Alps are not merely a geological—they are no less also an extraordinarily important meteorological—line of disturbance. In no case is this more clearly seen than in following a cold mass of air, which has struck against the northern Alps in its passage across the Alps. It is then evident how the Alps do not indeed ward off the northern winds, but by compression warm the cold air-masses, and so, in most cases, protect the southern stations from the sudden and intense variations of temperature prevailing on the north side."

The Wolf in Switzerland.—An interesting study of the history of the wolf in Switzerland has been made by Dr. K. Bretscher, who has examined a number of historical works and documents with a view to collecting records of its occurrence from as early a date as possible. In the *Neujahrsblatt* of the Zürich Natural History Society (108 Stuck, 1906), he quotes in chronological order the various references which he has discovered, and, though realizing that these are far from complete, he thinks that they are sufficient to give a correct general view of the subject. He groups the entries under two main headings, which he distinguishes as, firstly, the period of the general occurrence of the wolf in Switzerland, and, secondly, that of its decline and disappearance. Apart from the evidence of its presence in the age of pile-dwellings, and that supplied by place-names, in which "wolf" forms a frequent element, the earliest reference which he is able to adduce is to a decree of

Charlemagne of about the end of the eighth century. From this time to the latter part of the fourteenth century the records are exceedingly scanty; but during the next three centuries they become very common, and show the strenuous fight against the marauder which had to be maintained by the inhabitants, and the part which it played in their superstitious ideas. A striking fact is its abundance at the beginning of the seventeenth century, which is explained as resulting from the devastation of the Thirty Years' War. With the end of that century the period of its greatest abundance closed, and from hence onwards it begins gradually to disappear, the last wolf, so far as Dr. Bretscher can make out, having been killed in Lucerne in 1865, while the western frontier districts continued to suffer from its ravages until quite a recent date. The extermination of the animal has only been made possible by the introduction of modern weapons.

Phytogeography and Human Settlement in Germany.—Following up previous articles, and under the immediate stimulus of a recent publication of A. M. Hansen, Dr. R. Gradmann discusses, in the *Geogr. Zeitschrift* (vol. 12, No. 6), the subject of the open or steppe lands of ancient Germany, and their settlement by man. Specific steppe plants are still distributed in no small numbers over Central Europe, in localities having the greatest similarity with the steppes proper of the East, though confined to extremely circumscribed areas—dry hills, sunny rocks, steep slopes with free southern exposure. Never single, they occur there always in a small clique as most prominent constituents in a botanical formation known variously as pontic, South German, steppe-heath, etc. It is with plants shy of cultivated soil, and found, if found at all, solitarily and exceptionally in cultivated land, that the article deals. A comparison of the distribution of steppe vegetation with the distribution of prehistoric settlements mapped out in an earlier number of the *Zeitschrift* brings strikingly to light a far-reaching coincidence between the two, only the coast lands in the north failing to show such coincidences; for though rich in ancient settlements, they grow no steppe plants. The suspicion that such substantial coincidences may be mere accident is conclusively confuted by Hansen's recent discovery. Without knowing anything of the coincidences above specified in Central Europe, and on the sole basis of anthropological and geological investigations, Hansen demonstrated the fact that in Norway the oldest settlements, the names of which end in -vin and -heim, follow the distribution of the association of plants styled by him the "Origanum-formation," which is most intimately related to Gradmann's steppe-plants. They belong, as Hansen states, to Blyth's boreal and subboreal floral element, a group of warmth-loving xerophilous plants of preponderantly southern distribution, settled on lightly wooded or unwooded southern slopes, especially of the Silurian formation, in neglected localities, and most richly represented in South Sweden and in Öland. From spot to spot, Hansen traces both groups of phenomena (plant-groups and settlements), and presents the results in a map, in which the coincidence appears complete, down to a few readily resolvable exceptions. He also deals with the characteristic features of the regions of distribution, and demonstrates that the characters distinguishing the habitats of steppe plants (viz. relatively continental climate, with scant precipitation, fine-grained and calcareous soils) are the same that in the steppe lands of the East are known as unfavourable to forest and, directly or indirectly, conducive to steppe formation.

A Vegetation Map of Servia, by Prof. L. Adamović, is given in *Petermanns Mitteilungen*, No. viii., 1906, with letterpress describing the broad characteristics of the vegetation in the floral regions into which the country may be divided. The most striking feature is the wide difference which exists between the south-east and the north-west portions. This is not due so much to difference of latitude (although southern Servia closely approaches the parallel of 42°, which

forms the northern limit of Hann's subtropical climatic region in the Balkan peninsula) as to the configuration of the surface, the cold currents of Central Europe finding easy access to northern Servia across the broad Hungarian lowland. The climatic characteristics which distinguish the south-eastern part of the country are—(1) The later arrival and shorter duration of winter; (2) the smaller precipitation, especially in the height of summer, when vegetation is here generally at a standstill; (3) a sunny and warm late autumn, following on the equinoctial rains. It results that many warmth-loving, Mediterranean plants thrive in southern, though absent from northern, Servia, while even analogous plant-formations show differences as regards the dominant species, and the time of flowering and ripening is quite different in the case of cultivated plants. Of especial importance, too, are the orographical features of the country, the nearly continuous mountain ranges to the east forming a shelter against east winds, while the mountain complexes in other parts act differently by causing a greater precipitation, a milder summer, but a more severe winter. The petrographical character of different regions has an important influence, the plants of the limestone formations being quite different from those of the rocks rich in silicates. The effect of the hydrography is also to be noticed, the valleys of the Danube and other rivers supplying ways of access for plants of neighbouring regions. Lastly, the climatic changes brought about by the glaciation of the ice age did much to favour the spread of the Central European flora. Prof. Adamović divides the whole of Servia into seven regions (broadly on the basis of altitude), with a concurrent division into four "zones," occupying respectively the west, north-west, east and south, and extreme north-east of the country, the last zone being limited to a part of the Danube valley. The map marks the limits of all these divisions, while the distribution of characteristic plants is shown by symbols.

ASIA.

Journeys in Bhutan: Geology of the Outer Himalayas.—Now that friendly relations have, after a long interval, been once more established between the Indian Government and the ruler of Bhutan, it has again become possible for Englishmen to travel in the country, which until last year had not been entered by a British mission since the unfortunate experiences of Mr. Eden in 1864. It will be remembered that, in recognition of the friendly attitude maintained by the Tongsa Penlop during the expedition to Lhasa, that ruler received the K.C.I.E., and that a mission was despatched to Punakha early in 1905, under Mr. Claude White, political officer for Sikkim, to invest him with the insignia of the order. This mission entered Bhutan from the Chumbi valley, making its way to Punakha *viâ* Paro and Tashi-cho-jong. In several parts, both of the outward and return journeys, the route led over ground not previously traversed by Europeans, and the existing maps were found to be inaccurate in many respects. This year our knowledge of the country has been further advanced by a journey carried out by Mr. White in its eastern portion. He was accompanied by Mr. Guy Pilgrim, of the Geological Survey of India, whose observations, made under some difficulties owing to the rapidity of the march and the dense covering of vegetation, afford some indication of the geological structure of the outer Himalayas of this region, for which the data had hitherto been extremely scanty. Mr. Pilgrim gives a summary of the results in the 'Records of the Geological Survey of India' (vol. 35, part 1, 1906). They tend to fully confirm the conclusions based on previous work to the east and west, and justify the belief that the formations known as the Upper Siwaliks, Gondwanas, Purana metamorphic rocks, and older gneiss (occurring in this order from south to north) have a more or less continuous outcrop from

Nepal to the Subansiri river, or even further. The start was made from Gauhati on the Brahmaputra, the route leading over a flat grass-covered plain, with thin jungle, to the foot of the hills, where the true sub-Himalayan rainy forest begins. Around the debouchment of each river into the plain there is a collection of unstratified drift, which overlies unconformably the blue Siwalik clays and sandstones, and forms the surface of many of the hills that border the plain. Throughout the zone of the Siwaliks the beds appear to preserve the same sequence, and dip regularly at angles of 50° to 60° towards the north-west. The Gondwana beds occupy thin bands, of doubtful continuity, on the inner side of the Siwaliks, the total thickness exposed being about 500 feet. The Purana series, on the other hand, occupied the whole extent of country traversed on the outward journey, from the Siwalik boundary to the furthest point reached. This was in the valley of the Kuru Chu—the western upper branch of the Manas—the general direction of the march being north-north-west. The most prominent rock formation is a white quartzite of at least 10,000 feet in thickness. In ascending the western branch of the Pagla Dia river, it was found to form cliffs 5000 feet high, and seemed to be overlain by red schistose slates, with layers of quartz. Beyond the summit of the Tungka La (crowned by a monastery), on the southern limit of the Manas basin, a zone of smaller rainfall was entered, rocky hillsides, bare of almost everything but *Pinus longifolia*, being no uncommon sight even at 2000 to 3000 feet. On the slopes of Tungka La there are forests of oak quite devoid of undergrowth, while *Rhododendron arboreum* becomes common. The country has but a scanty population. The quartzite was again seen on both sides of the Manas, as well as on the descent to the Kuru Chu, and from its thickness seems undoubtedly to belong to the Baxa series of Mallet. This conclusion is strengthened by its association with a dolomitic limestone, which, with slates, etc., forms the ridge of the Kenga La, between the Upper Manas and the Kuru Chu. These beds, though dipping under towards the quartzites of the Manas, appear to be of later age, forming a sharply folded syncline over which the older beds have been thrust in opposite directions. As in other parts of the Himalayas, overfolding and reverse faulting have played an important part here, making the sequence of the beds somewhat difficult to unravel. After returning to the plains, in part by a different route, Mr. Pilgrim went east along the base of the hills to examine the coal-beds near the debouchment of the Kala Pani, which belong to the same formation as those at Darjiling and elsewhere. He thinks it doubtful whether the coal could be profitably exploited.

Dr. Zugmayer's Expedition to Tibet.—Dr. Erich Zugmayer, a young naturalist who has already gained some experience as a traveller during a journey in Western Asia, described in his book, 'Eine Reise durch Vorderasien,' has lately undertaken an expedition to Tibet, which he hopes to cross from north to south, returning through India. According to information communicated by him to the Vienna Geographical Society (*Mitteilungen*, 49, 441), the traveller reached Polu, on the southern border of Chinese Turkestan, in June, 1906, having travelled by the newly opened trans-Aral railway to Tashkend, and thence proceeded *viâ* Kashgar, Yarkand, and Khotan. From the last-named place he had executed a route survey, making also astronomical and meteorological observations in addition to those relating to his more special subject, natural history. He had already sent back from Polu three cases full of the collections made during the earlier part of the journey. From Polu he hoped to cross the Shu-bashi pass, and to examine an area hitherto blank on the map before striking the route of Dutreuil de Rhins.

M. Pelliot's Expedition to Central Asia.—We learn that this expedition, which is to occupy two years (*Journal*, 27, 87), reached Kashgar in safety on August 29 last.

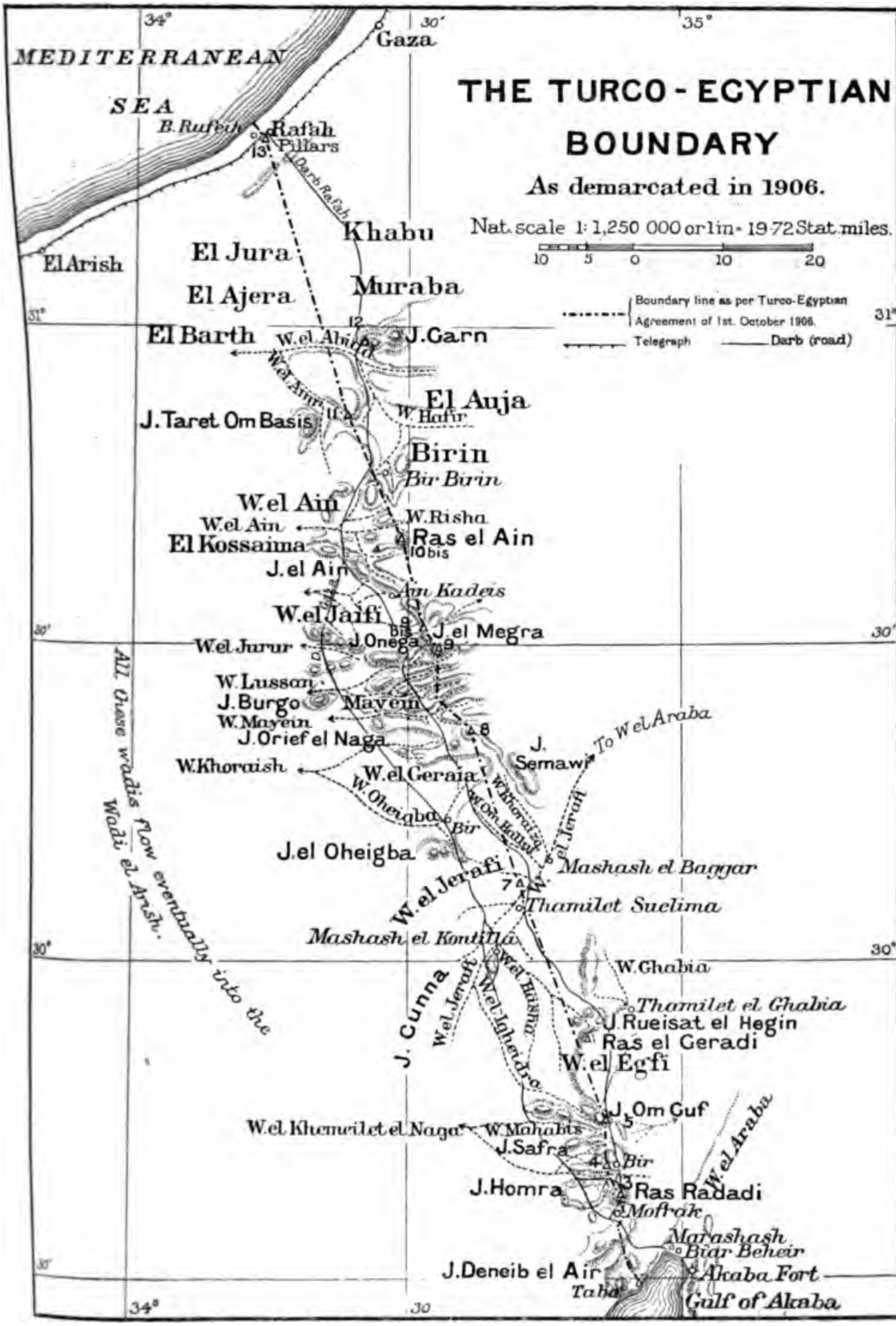
AFRICA.

Completion of Mr. Vischer's Journey across the Sahara.—A telegram received at the Society on December 19 announced the safe arrival in Northern Nigeria of Mr. Hans Vischer (*Journal*, **28**, 181, 507, 635), who has thus successfully accomplished his intention of crossing the Sahara by the route south from Tripoli. Any anxiety which might have been felt owing to the news of an attack on his caravan is therefore now allayed. Further details will be awaited with interest.

The Western Boundary of Uganda.—A joint commission has been appointed for the survey of the line of country through which passes the boundary now in dispute between the Congo State and this country in the region of Lakes Albert and Albert Edward. The British commissioner is Major Bright, R.E., who has already done much excellent survey work in connection with African boundaries and who will leave for the scene of operations early in January. For the Congo State the well-known explorer Major Lemaire has been appointed commissioner. The work of the commission will be limited to a precise survey of the country in question, the final decision as to the line to be adopted resting with the respective governments. It will be remembered that the Congo State claims that the 30th meridian, chosen as the boundary in the agreement of 1894, should be strictly adhered to, while the British Government contends that the obvious intention of that agreement, as deducible from the delineation of the geographical features on the best maps existing at the time, should be made the basis of settlement.

The Turco-Egyptian Frontier.—The map on the opposite page shows this frontier as defined in the agreement of October 1, 1906, based on the work of the joint commission appointed earlier in the year in accordance with the preliminary arrangement between Great Britain and Turkey (*Journal*, **28**, 290). The map is a reduction from that accompanying the agreement, lithographed at the Survey Department, Cairo.

Mount Meru.—A comprehensive account of Mount Meru, including its flora, fauna, ethnography, cultural capacity, and æsthetic character is presented in an article by Dr. Fritz Jaeger in the fifth number of the *Geogr. Zeitschrift* for the present year, illustrated by five fine landscapes from original drawings by Prof. Dr. Carl Uhlig, whom the writer accompanied on his expedition to the mountain. Distant only 12½ miles from base to base, though 43 miles from summit to summit, Meru and Kilimanjaro eject their tuffs into one another. From flat steppe lands 2500 to 4000 feet high Meru towers up, in a pretty regular cone, to 15,700 feet. The surrounding land and the lower parts of the mountain have on the whole a gentle outward slope, the regularity of which, however, is interrupted and enlivened by many parasitic volcanoes. Especially on the south foot there lie a great number of such hills, forming landmarks in the wide southward-sloping steppe. Crater forms recognizable on the hills and fine-tuff formations show that the whole foreland was formed by parasitic outbursts, which threw up, not isolated hills, but a continuous upland. The north side of Meru, rising steeply out of flat steppe, is surmounted by a great sharp cone, the remains probably of the rampart of a considerable crater sunk into the north flank of the mountain. The higher slopes of the mountain-cone have on all sides an inclination of about 30°, whereas Kilimanjaro rises with an average inclination of 8° to the saddle-plateau between its two main peaks. Though not advanced enough to destroy the form of the mountain, erosion has yet given rise to many detached forms, and by difference in intensity has variously sculptured the sides of the mountain. The south and east slopes, exposed to the prevailing south-east monsoon, are deeply furrowed by radial gullies, whence considerable brooks


THE TURCO-EGYPTIAN BOUNDARY
As demarcated in 1906.
Nat. scale 1:1,250 000 or 1in = 19·72 Stat. miles.
Boundary line as per Turco-Egyptian Agreement of 1st. October 1906.
Telegraph
Darb (road)
MEDITERRANEAN SEA
Gaza
B. Rufeih
Rafah
Pillars
Darb Rafah
El Arish
Khabu
El Jura
El Ajera
Muraba
El Barth
W. el Abiad
J. Garn
El Auja
W. Hafir
J. Taret Om Basis
Birin
Bir Birin
W. el Ain
W. Risha
Ras el Ain
El Kossaima
J. el Ain
Ain Kadeis
W. el Jaifi
J. Onega
J. el Megra
W. el Jurur
W. Lussan
J. Burgo
Mayein
W. Mayein
J. Orief el Naga
J. Semawi
To W. el Araba
W. Khoraish
W. el Geraia
W. Oheigba
Bir
J. el Oheigba
Mashash el Baggar
W. el Jerafi
Thamilet Suelima
Mashash el Kontilla
All these wadis flow eventually into the Wadi el Arish.
W. Ghabia
Thamilet el Ghabia
J. Rueisat el Hegin
Ras el Geradi
J. Cunna
W. el Egfi
J. Om Guf
W. el Khemeilet el Naga
W. Mahabis
J. Safra
W. el Araba
J. Homra
Ras Radadi
Mofrak
Marashash
Biar Beheir
J. Deneib el Air
Akaba Fort
Taba
Gulf of Akaba

flow. Especially to be distinguished are (1) The bounding-wall of a mighty caldera, open towards the east, sunk into the cone of Meru; (2) remains of a ring-wall south-south-west of the caldera; (3) approximately horizontal lava layers south-west of the caldera, lying discordantly on walls, and breaking off steeply eastwards; (4) the central cone, on which an outer rampart can be distinguished from an inner summit; (5) a lava-stream filling up the north half of the caldera floor. This lava-stream, 3 miles long and over half a mile broad, is estimated to be not more than a century old; the latest additions hardly a quarter of a century. It is mentioned that a considerable number of Boer families have settled on Meru, having erected farms chiefly on the south-east foot, where there is suitable meadow-land. A German farmer is established at the Arusha station.

The Mineral Belt of South Central Africa.—The report lately issued by the "Tanganyika Concessions," the syndicate which has secured the mining rights in the richly mineralized area in the Katanga district of the Congo State and the adjacent part of North-Western Rhodesia, is of interest as showing the progress made so far towards a development of the resources of this region, though not containing much matter of strictly geographical character. The existence of rich copper deposits in this region (to some extent exploited by the natives) has been long known, but it has only recently been ascertained that tin occurs in some quantities throughout a belt of country extending over 110 miles. The outcrops hitherto discovered have been carefully mapped, and the results are shown in a collection of maps and plans accompanying the report, among which is a plan of the reefs at Kasonso, the most important of the recent discoveries. The copper belt extends for a length of 200 miles, and contains also the Ruwe gold-mine, already in course of exploitation. It is stated that there are millions of tons of high-grade copper ores ready to be quarried, and that they compare for ease of working with the iron-mines near the head of Lake Superior. A trigonometrical survey of the ore-belts above referred to is being carried out. The examination of the Kanshanshi copper-mine in North-West Rhodesia has been continued with promising results. Transport to the mines has hitherto been effected by the Zambezi-Nyasa route and the Luapula, the time taken to transport goods from London being from six to seven months. The railway from the Victoria falls has made rapid progress, while, as is known, a line has been begun from the west which is to connect the mining region with the east coast at Benguela. In the hopes of utilizing this route in the immediate future by means of waggon transport, an expedition was organized in 1905 under Mr. H. I. Brown, who secured the co-operation of Major Boyd Cunningham. The Ruwe mine was successfully reached with ox-waggons, the route following in the main the Congo-Zambezi water-parting after reaching the interior plateau. Mr. Brown reports favourably on the suitability of the country, and thinks that, with careful organization, regular transport may be established by the aid of the Dutch settled in Angola. A map of the route is given, but no information is supplied as to the method of its construction. It agrees generally with those of Gibbons, Lemaire, and other travellers by this line of country, and these would seem to have been used as a basis. In any case, any additions to the cartography of the region will be chiefly in matters of detail. There is also a route-map (but no report) of an expedition to Lunda made by Mr. M. J. Holland, who reached a point on the Luembe tributary of the Kasai in 8° S.

AMERICA.

The Chibougaman Mining Region, Quebec.—An official report, by Mr. A. P. Low, on the Chibougaman mining region in the northern part of Quebec Province (Ottawa, 1906), sketches its physical features and mineral resources,

which include asbestos, gold, copper, and iron ores. About 80 miles from east to west by about 70 from north to south, and 280 miles north of Ottawa city, the region extends from 49° 30′ to 50° 30′ N., and from 73° 40′ to 75° 30′ W. Accompanying the report is a geological map on the scale of 4 miles to an inch. A large mass of gold-bearing quartz has been discovered, and in many places veins of asbestos of sufficient size and number to form valuable deposits. All active work, however, in the mines, Mr. Low concludes, must await the construction of a railway to the shores of Chibougaman lake. A rolling tableland, immediately north of the Height of Land dividing the waters of the St. Lawrence from those of Hudson bay, the region has a general elevation of 1400 feet above sea-level near the watershed, but falling gently to less than 900 feet in the north-west. The surface is everywhere broken by long low ridges of rocky hills rising in general to not more than 50 feet above the surrounding water-levels, and trending from east-north-east to west-south-west. The ridges are often wide apart, and the shallow valleys are covered with networks of lakes fringed with wide areas of swampy land. Three-fourths of the region is drained by tributaries of the Obatogaman and Chibougaman rivers, which at their junction form the Waswanipi branch of the Nottaway river that flows into Rupert bay (south-eastern extension of James bay). Immediately on the north-west side of the watershed a string of large lakes extends many miles north-eastwardly. First on the south side is Obatogaman, 11 miles long, but divided almost into six lakes, and so crowded with islands as to make the passage between them a perplexing one. Next are Chibougaman, 20 miles long by 6 wide; Wakonichi, 20 miles long by 3 broad. North of these are seen in the map the southern bays of Mistassini. All the usual sub-arctic trees occur. Over three-fourths of the surface explored is covered with old forest, or with second growth of thirty years and upwards. The lands from 900 to 1500 feet above the sea, of doubtful value agriculturally, may be available for grazing. With a railway providing quick transport, the fisheries of the larger lakes would prove valuable.

AUSTRALASIA AND PACIFIC ISLANDS.

British New Guinea.—The Annual Report of the Administrator for the year ending June 30, 1905, shows that, while no very marked advance had taken place during that period, the situation was on the whole generally satisfactory. In various quarters new tribes had been brought under Government influence, while in the case of others which had given trouble in the past (*e.g.* the inhabitants of Kiriwina, in the Trobriand group) there had been signs that they were realizing the futility of further resistance. The authority of the village constables who have been entrusted with the task of preserving order over a large area within the possession, seems to be exercised with beneficial results. Even in the Western Division, the people of which have been especially difficult to deal with in the past, we read that Government influence is being gradually extended over new tribes, especially on the Fly and Bamu rivers; but progress can only be maintained by unrelaxed supervision, retrogression having been noticed during a six months' absence of the resident magistrate. In the older districts the indolence and apathy which results from the cessation of tribal wars is a serious difficulty, to combat which agricultural development is looked to as the most powerful weapon; but this has not yet begun on any large scale. In the northern division, which contains tracts suited for sugar, coconuts, coffee, tea, and cacao, much of the land being described as of unsurpassed richness, nothing has been done so far to exploit these resources. Gold-mining, too, seems to remain in a stationary condition. Among the journeys made during the year by the administrator, the most interesting were: (1) That through the northern division, by the new road to Kokoda (a station recently

established in the Yodda valley), and thence to Tamata; (2) an inland expedition from Port Moresby to Kokoda by the Gap in the main range. Carriers were forthcoming in good numbers for the former journey, and though only recently emerged from the rawest barbarism, they exhibited a cheerful confidence that was most satisfactory. From a point south of Buna bay (the starting-place of the Yodda road) a visit was paid to the Agaiambo tribe, whose peculiar physique and habits were alluded to in the report for 1903 (*Journal*, vol. 25, p. 678), but of whom a few only seem to survive. Some of the reports to which the former description gave rise were absurdly exaggerated, though the present administrator confirms the abnormally small development of the legs, probably arising from their constantly kneeling to paddle their dug-outs. The other expedition was made with a view to testing the practicability of establishing an overland mail service between Port Moresby and Kokoda, as well as visiting the strong tribes of hillmen not previously brought under proper control. It succeeded in both objects, a fortnightly service being inaugurated, which enables a mail-bag to reach Kokoda in seven days, instead of the six weeks or more involved by the sea-route; while several inland tribes have been brought into friendly touch with the Government and with each other.

Plant-ecology in New Zealand.—The comparatively new study of plant-ecology has found a keen exponent in Dr. L. Cockayne, whose notes on the floristic features of the island groups in the ocean to the south have already been referred to in the *Journal* (vol. 25, p. 461), and who has lately sent us reprints of two papers from the *Transactions* of the New Zealand Institute (vol. 38, 1905). One of these discusses the sub-alpine scrub formation, which occurs over large portions of New Zealand, especially as a thick and almost impenetrable belt of shrubs between the sub-alpine forest and sub-alpine meadow on many of the mountain ranges. Special reference is made to this formation on Mount Fyffe, in the high range known as the Seaward Kaikouras, on the east coast of Marlborough, to which the author lately paid a visit, thus extending the knowledge gained from ascents made in 1892. Generally the scrub in question consists of shrubs or low trees, belonging to diverse genera and orders, but generally agreeing in their evergreen character and apparent adaptation to xerophytic conditions. Even in adjacent localities the general appearance of the scrub may vary so much as to permit the determination of the dominant species from a distance. On Mount Fyffe it is marked by the unusually small number of species and by the presence of *Cassinia albida*, a plant with sage-green foliage peculiar to the locality, and so abundant as to form in places almost a pure formation. Precise data as to the climate of Mount Fyffe do not exist, but, though snow lies on the upper parts for six months of the year, the winter cold on this and other New Zealand mountains is probably not so severe as is sometimes thought. The rainfall is very considerable, and the xerophytic character of the plants seems out of place. It is probably, Dr. Cockayne thinks, a survival from a former period when large areas in New Zealand were extremely arid. The existing vegetation might be considered to supply arguments both for and against the theory of the extreme youth of the Kaikoura mountains, and further facts must be collected before a definite opinion can be pronounced. The other paper describes a hurried visit to the Poor Knights islands, a group lying in the open ocean some 11 miles from the east coast of northern Auckland, which had not previously been visited by a naturalist. Dr. Cockayne divides the plant formations into cliff, tall scrub, and meadow, with a minor formation composed principally of salt-loving plants. Of these the scrub occupies the gullies and much of the flatter ground above the precipices, the dominant plants being *Suttonia divaricata* and *Macropiper excelsum*. The presence of the former was unexpected, as it is by no means a common plant in northern New Zealand, though one of the characteristic forest or scrub plants of the

Auckland and Campbell islands. Another striking characteristic was the luxuriance of the foliage of many of the plants on such small wind-swept islands as the Poor Knights. One or two other of the species noticed have only a limited distribution in New Zealand, and occur nowhere else so far to the north. This distribution may be due to a shrinkage of the land surface and extinction of plants over wide areas.

POLAR REGIONS.

Canadian Expedition to the Northern Archipelago.—The *Arctic*, formerly the *Gauss*, the ship of the German Antarctic Expedition, which, after the return of the latter, was purchased and renamed by the Canadian Government, sailed for northern waters in July, 1906, under the command of Captain J. E. Bernier, with the object of taking possession of various Arctic islands in the name of the Canadian Dominion. Passing through the Baffin bay pack, the *Arctic* reached Bylot island on August 18, and entered Lancaster sound. The *Gjöa* depôt at Port Leopold was visited on the 23rd, and 5718 lbs. of provisions deposited, the voyage being continued on the 24th along the eastern edge of a closely packed ice-field to Griffiths island, and thence towards Cornwallis and Bathurst islands, where cairns were built and records of the taking possession were left. Before reaching Point Cockburn on the latter, the ship was beset for three days only 300 yards from open water. Near the point, the record left by McClintock in 1851 was discovered. *En route* for Byam Martin island very heavy Arctic ice was passed, but a landing was effected just west of Cape Gillman, Melville island being reached on the 30th. Landing at a point named by him Arctic Point, in 75° 6′ N., 106° W., Captain Bernier took formal possession of Melville, Prince Patrick, Eglinton, Emerald, and adjacent islands. During the return voyage the *Arctic* touched at Lowther and Russell islands, and afterwards entered Peel sound, the eastern side of which was quite clear, so that the north-west passage seemed quite feasible. After landing and repairing the Franklin monument at Erebus bay (September 2 and 3), the expedition sailed for Admiralty inlet, and proceeded up it for some distance. Passing Arctic bay and Yeoman island, the ship sailed south-south-east up a large channel to a point in 71° 12′ N. about 85° W., where the water still extended to the east and south. Captain Bernier thinks, however, that there is no passage south by this way for a ship like the *Arctic*. Leaving this inlet, the expedition arrived at Pond's inlet on September 9.

North-East Greenland.—The first detailed account of the cruise of the Duke of Orleans on the north-east coast of Greenland in 1905 has been given by Commandant de Gerlache in *La Géographie* for September, 1906, accompanied by a large-scale chart of the sea between Spitsbergen, Greenland, and Iceland. As is well known, the ice-pack which blocks the northern part of this sea and descends to a lower latitude on the Greenland coast is among the most impenetrable that exist anywhere, and the duke's expedition was unusually fortunate in reaching the high latitude of 78½° in the *Belgica*. The ship had previously cruised in the waters north of Spitsbergen, and was thus already in a high latitude before proceeding to attack the closely packed ice-fields to the west. Following the edge of these in a southerly direction, every possible effort was made to push westward, with the result that after reaching a little south of 76° a passage was at last found, which brought the *Belgica* to the land in the neighbourhood of Cape Bismarck. While skirting the ice, as well as during the passage through it, the navigators carried out a complete series of soundings, besides other oceanographical work, and the results were of considerable interest. On July 15 and 16, a little north of 78° the soundings fell rapidly from 1476 to 1152 fathoms, and a little later to 779 fathoms, indicating a rapid rise from the floor of the deep channel west of Spitsbergen. This was particularly interesting on a comparison with the soundings afterwards made in about the

same latitude off the Greenland coast. The first land visited was a small island a little south of Cape Bismarck, and here a comparatively rich flora, including the Arctic willow, was found growing in every small depression. To the north a channel was found to extend between the pack and the land-ice, and by pushing up this the voyagers continued to increase the latitude, in spite of constant fog which rarely permitted a view of the mainland. Cape Bismarck appears to form part of an island, and to the north-east of this another island was discovered, on which a still richer flora than that already noticed was found. The island (named Ile de France, and pronounced to be an ancient moraine) was nearly bare in the south, while the centre and north were covered with a cap of névé. Signs of the former passage of Eskimo were seen in the form of (apparently) a fox-trap, and this seems to support the idea that the tribes which formerly occupied the east coast came down from the north. A little north of 78° the ship pushed out into the pack at right angles to the previous course, and the soundings, which near the edge of the land-ice reached 257 fathoms, fell to 54, and even to as little as 32 fathoms, giving another indication of a submerged bank, if not of an island, in this part of the Greenland sea. But it was impossible to carry the examination further. During the return voyage the duke and Dr. Récamier attempted to reach the land by crossing the belt of ice along the coast, but an intervening stretch of water frustrated their purpose. Just north of Cape Bismarck traces of Eskimo were again seen. From what was seen of the land, it seems, as is the case further south, to be intersected by deep fjords, probably communicating with one another in their inner parts. The interior is covered with an inland ice-sheet, but no glacier seems to reach the sea, nor was any true iceberg seen during the whole stay in these waters. Alternating tidal currents were noticed off the edge of the land-ice, that to the north being sufficiently strong to counteract the effect of the polar current. The land-ice presented a quite different appearance to the north and to the south of the Ile de France, that to the north seeming never to separate from the coast, while that to the south is winter ice only. During the whole stay on the coast, fog prevailed on an average one day in two. Beyond the Koldewey islands (just north of 76°) the voyage was continued south through fairly loose pack, at a little distance from the land, open water being reached a little north of 70°.

GENERAL.

The Voyage of the "Planet."—Preliminary accounts of the outward voyage of the German surveying ship *Planet* (*Journal*, vol. **28**, p. 80) have already appeared in Germany. Reports on the hydrographical work have been printed in the *Annalen der Hydrographie*, while a summary of the work in all departments as far as Colombo has been contributed to *Globus*, vol. **90**, p. 102, by Dr. Krämer, who accompanied the expedition as a member of the scientific staff. The soundings obtained will permit various corrections or additions to the charts. Thus south of the Cape Verdes a depth of 5130 metres (2805 fathoms) was found on the site of a supposed bank with only 1160 fathoms. The contour of the ocean-floor from oceanic depths to Sierra Leone was determined, while the submarine ridge discovered by the *Valdivia* off the coast of South-West Africa was further examined. From Cape Town a cruise to the south was undertaken, and, though hampered by bad weather, the observers (after touching at Durban) were able to show that the shoal supposed to have been found by the *Cyclops* about the middle of last century in 36° 40′ S., 41° 20′ E., must be expunged from the chart, depths reaching 5400 metres (2952 fathoms) occurring at the spot. On the other hand, a bank with only 1372 metres (750 fathoms) was found in 33° S., 36° E., and one with depths varying from 1500 to 2500 metres (820 to 1360 fathoms), extending south from Madagascar

to 32° S. Soundings were also taken along a line running east from Madagascar, which showed a steep but regular drop. Dr. Krämer himself landed at Cape Town, rejoining the ship at Durban, and, among other studies, examined members of the supposed pygmy race of the Valpens, whom he pronounces to closely resemble the Basuto, with merely a touch of Bushman blood. In the Indian ocean studies of coral formations were made near Rodriguez, and at Suvadiva in the Maldives, and the writer found support for the ideas of Voeltzkow in regard to the part played by sedimentation in helping to build up the reefs. At Suvadiva, Dr. Krämer, who has a close acquaintance with the coral islands of the Pacific, was struck by the luxuriance of the vegetation, although, to his surprise, the chief constituents of the undergrowth were almost identical with those already familiar to him. The *Planet* was unable to confirm the existence of the submarine reef indicated by the *Valdivia* in 20° 10′ S., 68° E. Among other observations taken by the scientific staff, those of the upper atmosphere, by means of kites and balloons, will be of interest as affording a comparison with those of Rotch, Hergesell, and others in the Atlantic. Complete series of temperatures of sea-water, with samples from different depths, were taken throughout.

Remarkable Voyage of a Float.—A note in the November number of the *Scottish Geographical Magazine* records the remarkable voyage made by one of the many floats thrown overboard during the voyage of the *Scotia*, of which five have already been returned to the Admiralty. Thrown into the sea on January 26, 1904, in 43° 10′ S., 54° 17′ W., it was picked up on the beach of Bridgwater bay, near the south-west corner of the colony of Victoria, on August 4, 1906. The distance travelled is some 9000 miles in a straight line, or on an average 10 miles a day without reckoning probable *détours*.

Hoar-frost at High Altitudes.—The meteorological observatory on the Hohen Sonnblick in the Tauern, publishes, in the fourteenth annual report of the Sonnblickverein for 1905, hoar-frost observations for the last three years. The following statements included among them are of general interest. By hoar-frost is understood spear and feather-shaped forms of ice, often several inches or even many feet long, arising on the wind side of objects exposed to the wind, through the freezing of drops of mist perceptibly underchilled, but yet fluid. This phenomenon occurs not seldom on the Sonnblick, but not in so pronounced form as, *e.g.*, on the Brocken (3744 feet high) or on Ben Nevis (4406 feet), both of which rise to the average level of the winter clouds. The Sonnblick (10,180 feet) shoots up into regions which in winter are deficient in moisture. On the Bjelašnica, in Bosnia (6782 feet), on the other hand, by reason of its more southern situation and its proximity to the Adriatic, congellation is very strong. On February 20, 1902, the hoar-frost spikes on the observatory there attained within three days a length of 22 feet, and on the column of the sunshine recorder 9 feet; this happened under a temperature of 27° Fahr. during slight faint south winds, and with an average relative humidity of 93 per cent. On the Sonnblick the needles grow at most to lengths of a few decimetres. On the "Regina Margherita" observatory (15,160 feet) on Monte Rosa, the highest meteorological observatory in Europe—which, however, unlike the "Zittelhaus" on the High Sonnblick, is not permanently inhabited—hoar-frost formation, to judge by the statements of Prof. Alessandri, likewise appears to be of frequent occurrence. On the Sonnblick there were, in 1903, thirty-six days; in 1904, fifty days; in 1905, thirty-nine days, with hoar-frost formation.

Jubilee of the Vienna Geographical Society.—An interesting function took place in Vienna on December 15, when the Geographical Society of that city celebrated the completion of the fiftieth year of its existence. Discourses were pronounced by the Archduke Rainer, "Protector" of the society, and by Dr. Emil

Tietze, its President, who briefly recounted the facts connected with the founding of the society, and its growth in numbers and influence during the past half-century. While the first list of members included only 264 names, and the numbers had risen to 645 at the completion of twenty-five years, the number of ordinary members now amounts to 1896. Of the original members, nine, including Count Hans Wilczek and Prof. E. Suess, still survive. The gathering comprised delegates from other geographical and learned societies both in Austria and foreign countries, our Society being represented by its honorary corresponding member, Prof. Suess, who presented an address on behalf of the Council. A number of distinguished foreign geographers were named as honorary and honorary corresponding members in honour of the occasion, and in the former category we are pleased to find the names of Sir John Murray and Dr. H. R. Mill. In a speech of felicitation, Prof. Suess remarked on the change which had taken place in the status of geography during the past half-century, it being now the most closely in touch with practical life of all the sciences.

Life of Sir T. Gordon: Erratum.—In the notice of Sir T. Gordon's autobiography in the December number (p. 630, second paragraph) Lord Mayo's name has, by an obvious slip of the pen, been substituted for that of Lord Dufferin.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1906-1907.

First Meeting, November 12, 1906. The Right Hon. Sir George T. Goldie, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

The President: At this opening meeting of our session, I do not propose to pass in review the geographical events which have occurred during our recess, because, as I think I explained to you last year, it is found more convenient to deal with the geographical history of each year at our annual meetings in May, partly in order to preserve continuity of record and facility of reference in the future, and partly also because naturally we have a larger number of Fellows from all parts of the country present at our general meetings in May than we can expect to get at these ordinary meetings.

But before I introduce the reader of the paper to-night, I wish to make two or three remarks of a perhaps discursive character. We are honoured to-night by the presence of His Excellency the Italian ambassador, whom we welcome here, not only as the representative of a country with whom Great Britain has had the most cordial and sympathetic relations ever since, under King Victor Emmanuel, Italy became like ourselves a united kingdom, but also because His Excellency is a geographer who has been President of the Geographical Society of Italy, and, as a matter of fact, he has only resigned or is resigning that presidency of the Geographical Society of Italy because he has taken up the post of ambassador at the court of St. James. In giving a welcome to His Excellency we are, therefore, doing honour to that sister Geographical Society of Italy which has done such notable and such extremely valuable work in our joint science. And as I am speaking on the question of Italian contributions to geography, I think I may as well mention the fact now that His Royal Highness the Duke of the Abruzzi has arranged to attend at our evening meeting on January 14 * next, when his paper will be read dealing with his highly successful exploration of Mount Ruwenzori, and I have no doubt we shall have the honour of seeing His Excellency the Italian ambassador present on that occasion too.

* Date since changed to January 12.

I wish to take this the earliest practicable opportunity of making a slight correction or addition to a statement in my address at the annual meeting last May. I was speaking of the expedition which is known now as the Alexander-Gosling Expedition, and I briefly mentioned a map which I stated had been prepared by Mr. P. A. Talbot. The representative of the late Captain Claud Alexander, of the Scots Guards, wrote to me, very properly, to point out that his son Captain Claud Alexander and Mr. Talbot were conjointly responsible for the survey. I desire to make this clear all the more because Captain Claud Alexander is no longer with us, and one wishes naturally to do justice to a dead man even more than to a living one. I may say that Mr. Talbot, who has since come home, did a large part of the survey and other work, and it was with him we had to deal in the Royal Geographical Society. He attended at the map room and assisted in the preparation of the work. As I am on the subject of the Alexander-Gosling Expedition, I should like just to remind you that since we last met there appeared in the papers and in our *Geographical Journal* an announcement of the death of another member of the expedition, Captain Gosling, of the Rifle Brigade. You will share our deep regret at this further loss. Fortunately, the real leader of the expedition, Lieut. Boyd Alexander of the Rifle Brigade, the brother of Captain Claud Alexander, is still with them. When we last heard of them they were 300 or 400 miles south-west of Gondokoro.

Now, before I sit down, I feel sure that you will be disappointed if I do not express on behalf of our Society the great gratification that we felt on hearing, as you have seen in the papers, of course, about a fortnight ago, of the safety and success of the expedition of Commander Peary. I am quite sure it was with a feeling of joy you all saw the fact that Peary was safe, and, although he did not reach the north pole, which he has been trying to do for the last fifteen or twenty years, he has established a record by getting nearer the pole than any man living. You will remember the Duke of the Abruzzi was the last, with Captain Cagni, and they established the last record. But Commander Peary of the United States has now won the palm. We, of course, at once sent a cablegram of congratulation to the United States. We thought it best to send it to the chairman of Commander Peary's expedition, but I have no doubt he will intimate the fact of that congratulation to Mrs. Peary, who, as many of you know, accompanied her husband in an earlier polar expedition, and who herself established a very remarkable record up there which I think is not likely to be broken.

The paper read was:—

"North-Eastern Rhodesia." By L. A. Wallace.

Second Meeting, November 19, 1906. The Right Hon. Sir George T. Goldie, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

Elections.—*Frank P. Adams; Dr. T. P. Allen; Captain Wm. Gerald Ambrose (3rd Cheshire Regt.); A. M. Asquith; Lieut. F. M. Bailey, Indian Political Department; Henry Bell; Captain Frederick Ramon de Bertodano (8th Manchester Regt.); Frank Hepburn Chevallier Boutell; Carl Bovallius, M.A., Ph.D.; Charles Talbot Bowring; John Bygott; Lieut. Herbert Cheetham, C.V.O., R.N.R.; Colonel Benjamin Silliman Church; George Ernest Clark; Captain H. C. L. Cock, R.A.; Alfred Howe Collinson, M.I.C.E.; Elmer L. Corthell, C.E.; Comm. Lancelot Baillie Denman, R.N.; John A. Dick, M.E.; William Frederick Dick; Carl Otto Max Diehr; H. S. Ker Edie; Lieut.-Colonel J. E. Edmonds, R.E.; Frederick Edwards; Major-General J. S. Ewart, C.B.; Frank Eustace Faithfull;*

John Richard Fisher; John Edward Foley; Harold Duncan Foster; Vivian Le Neve Foster; David Fraser; J. W. Fremantle; J. F. Gage, M.E.; Victor Herbert Gatty, J.P.; Wm. James Garnett; John Thompson George, M.E.; Captain C. M. Gibbon (Royal Irish Fusiliers); Captain H. M. Greaves; John Herbert Greene; H. Groves, M.I.C.E.; Henry Arnold Grube; James Cornwallis Gubbins; Major F. G. Guggisberg, R.E.; Harry Geary Gardner; Captain A. L. Hadow (Norfolk Regt.); Philip Edward Hall; Hubert Tyler Harrington; Arthur Henri; Arnold Wienholt Hodson; Prof. Frank A. Inglis, B.A.; Major J. W. Jennings, D.S.O., R.A.M.C.; William Johnson; George Benjamin Kipps; Charles Kliene; General Stillman Foster Kneeland; William Woodhouse Lawe; Captain W. T. Layard (Northampton Regt.); Albert Edward Leatham; Hamilton Leigh; Arthur Lewis, B.A.; Leonard Albert MacDonald; Andrew McClure, B.A.; Lieut.-Colonel J. A. L. Montgomery, C.S.I.; Viscount Mountmorres, F.L.S.; Brevet-Major Arthur Mudge (Queen's Regt.); Lieut. S. F. Newcombe, R.E.; William Lewis Newey; Raymond Parcon; F. H. Parry; Lieut. George Frederick Phillips (Scottish Rifles); Oscar Plaut; C. Verdon Quintan; M. Alfred Raquez; John Robertson; Charles Bradshaw Robinson, J.P.; John Henry Roscoe; Arthur Rose; J. C. Sciortino; Rev. J. C. Sherrill, D.D.; Edward Fraser Stanford; E. P. Stebbing; Cecil George Graham Stewart; Lieut. John J. C. Sullevans; Lieut. W. H. Tapp (Queen's Bays); Lieut. Richard Durand Temple (60th Rifles); Harold George Thurston; Spencer Trotter, M.D.; Lieut. Thurlow Richardson Ubsdell, R.F.A.; Derwent H. R. Waldron; Alfred J. P. Ward; Caspar Whitney; Rev. Samuel H. Wilkinson; Captain C. J. Williams; Noel Williamson; Charles John Wilson; Charles Wilton; E. C. Young; Patrick O'Dea, M.A.

HONORARY CORRESPONDING MEMBERS.

H.E. the Marquis di San Giuliano, Italian Ambassador, late President Italian Geographical Society; M. Auguste Pavie.

The paper read was :—

"The Seychelles Islands." By J. Stanley Gardiner.

Third Meeting, December 10, 1906. The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS.—*Bannister Fletcher; Dr. Hiram Bingham; Robert Moore Collins; E. G. Fenning; Lieut.-Colonel M. L. Hearn, R.A.M.C.*

The paper read was :—

"Irrigation in the United States: its Geographical and Economical Results." By Major John H. Beacom, U.S. Army.

RESEARCH DEPARTMENT.

December 14, 1906.—Major C. F. CLOSE, C.M.G., R.E., in the Chair.

"Heights of the Lakes and Mountains of Central Africa." By Captain T. T. Behrens, R.E.

Fourth Meeting, December 17, 1906.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS.—*Major George Herbert Arbuthnot, I.A.; A. Manley Archibald; Charles Beadle; Henry Thurburn Montague Bell; Allan Arthur Davidson;*

Harold S. W. Edwardes; Kenneth V. Elphinstone; P. L. Faulkner; Charles Reginald Ford; Matthew Hornsby; W. V. Legge (late Lieut.-Colonel R.A.); Henry F. Montagamer; Marcus Geddes Morrison; El Marquis de Oristan; John Howard Reed; Charles F. Ryder; Walter William Storr; P. C. Tarrapore; Harry White.

The paper read was:—

"Nine Years' Survey and Exploration in Northern China." By Colonel A. W. S. Wingate.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals; Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendes.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Eastern Europe. **Kinglake and Hogarth.**
Kinglake's Eothen. With an Introduction and Notes by D. G. Hogarth. London: H. Frowde, 1906. Size 7 × 5, pp. xxiv. and 296. *Illustrations. Price 2s. 6d. net. Presented by the Publisher.*

A tastefully got-up edition, printed in clear type and on good paper, though of a handy size. The introduction presents a sympathetic appreciation of the author and his book.

France—Brest. *C.R.A. Sc.* 142 (1906): 1379–1382. **Guyou.**
Application du téléphone et de l'Astrolabe Claude-Driencourt à la détermination de la longitude de Brest. Note de E. Guyou.

France—Cartography. *B.S.G. Lyon* 20 (1905): 97–114, 193–214, 288–300. **Raymond.**
Considérations sur la Carte de France. Par le Colonel Raymond.

France—Central Plateau. *B.S.G. Lille* 46 (1906): 5–25. **Eustache.**
Dans le région des "Puys." Par M. le Dr. G. Eustache. *With Maps and Illustrations.*

France—Cevennes. *Appalachia* 11 (1906): 110–114. **Davis.**
A Day in the Cévennes. By William Morris Davis.

France—Communications. *B.S.G. de l'Est* **26** (1905): 315–328. **Néro.**
Le Nord et l'Est de la France et les Voies d'Accès au Simplon. Par A. Nérot.

France—Hérault. ———
Géographie Générale du Département de l'Hérault, publiée par la Société Languedocienne de Géographie. Tome Troisième: Histoire Générale. 2^{me} Fascicule; Antiquités et Monuments du Département. Montpellier, [1905]. Size 9½ × 6½, pp. 199–754.

France—Hydrology. *La G., B.S.G. Paris* **13** (1906): 370–374. **Rabot.**
L'abaissement du niveau de la nappe aquifère en Beauce et dans le département de l'Yonne. Par C. Rabot.

France—Limousin. *B.S.G. Lille* **45** (1906): 358–378. **Paillot.**
Le Limousin. Par R. Paillot. *With Illustrations.*

France—Savoy. *Z. Gletscherkunde* 1 (1906): 31–45. **Girardin.**
Le glacier des Evettes en Maurienne (Savoie). Étude glaciologique et morphologique. Par P. Girardin. *With Map.*

France—Volcanoes. *La G., B.S.G. Paris* **13** (1906): 177–194, 275–300, 349–369. **Boule.**
L'âge des derniers volcans de la France. Par Marcellin Boule. *With Maps and Illustrations.*

Germany and Belgium. *Deutsche Erde* **5** (1906): 42–44. **Kirchhoff.**
Das grenzstreitige Gebiet von Moresnet. Von Alfred Kirchhoff.
On the small area left neutral in 1816.

Germany—Alsace. *Deutsch. Rundschau G.* **28** (1906): 344–352. **Werner.**
Das Sundgauer Hügelland im Ober-Elsass. Von L. G. Werner. *With Illustrations.*

Germany—Bavaria. **Branco and Fraas.**
Abh. K. Preuss. A.W. 1905. *Phys.-math. Cl.* i., pp. 64.
Das kryptovulkanische Becken von Steinheim. Von W. Branco und Prof. Dr. E. Fraas. *With Map and Sections.*

Germany—Bavaria. *Globus* **89** (1906): 363–367. **Jaeger.**
Der Schliersee. Von J. Jaeger.

Germany—Census. *Deutsch. Rundschau G.* **28** (1906): 418–419. ———
Vorläufige Ergebnisse der Volkszählung im Deutschen Reiche, 1905.

Germany—Commercial. **Halle.**
Die Weltwirtschaft; ein Jahr- und Lesebuch. Unter Mitwirkung zahlreicher Fachleute herausgegeben von D. Ernest von Halle. I. Jahrgang, 1906, II. Teil. Deutschland. Leipzig and Berlin: B. G. Teubner, 1906. Size 11 × 7½, pp. vi. and 254. *Price 4m. Presented by the Publisher.*
A valuable record of the condition and progress of German industry in 1905.

Germany—Harz. ———
The Harz. The most beautiful Mountain Region of Northern Germany. Guide issued by the Association for Promoting Travel to the Harz. With an introduction by Hans Hoffmann. Bad Harzburg: R. Stolle, 1905. Size 9 × 5, pp. 110. *Maps and Illustrations.*

Germany—Hessen. *Notizblatt V.E. Darmstadt* (4) **26** (1905): 75–81. **Greim.**
Schätzung der mittleren Niederschlagshöhe und Niederschlagsverhältnisse im Grossherzogtum Hessen im Jahre 1904. Von Dr. G. Greim.

Germany—Jena *M.G. Ges. Jena* **24** (1906): 1–8. **Piltz.**
Die Geländeform des Jenaer Schlachtfeldes. Eine graphische Darstellung nebst Erläuterungen von E. Piltz. *With Plate.*

Germany—Meteorology. *Petermanns M.* **52** (1906): 140–142. **Neumann.**
Deutschlands mittlere Jahres-, Januar-, April-, Juli- und Oktober- Temperaturen. Von Prof. Dr. L. Neumann.

Germany—Posen and West Prussia. *Deutsch. Erde* **4** (1905): 161–164. **Wendland.**
Der Einfluss der staatlichen Besiedlung in Posen und Westpreussen auf die Sprachenzugehörigkeit der Gemeinden. Von Hans Wendland. *With Map.*

Germany—Saxony. *Deutsch. Erde* **4** (1905): 81–92. **Meiche.**
Die Herkunft der deutschen Siedler im Konigreich Sachsen nach den Ortsnamen und Mundarten. Von Alfred Meiche.

Germany—Silesia. *Deutsch. Erde* 5 (1906): 2–5. **Partsch.**
Von der deutschen Grenzwacht in Schlesien. Von Joseph Partsch. *With Map.*
On the relations of the different nationalities on the Silesien frontier.

Greece—Historical. *Sitzb. K.P.A.W. Berlin* 1906 (1): 59–79. **Wilamowitz-Moellendorff.**
Ueber die ionische Wanderung. Von — von Wilamowitz-Moellendorff.

Holland. *Ts. K. Ned. Aard. Genoots. Amsterdam* 23 (1906): 839–876. **Beekman.**
De vloed van 12 Maart 1906 in Zeeland. Door A. A. Beekman. *With Map.*

Holland and Germany. *Nineteenth Century* 60 (1906): 25–38. **Ellis-Barker.**
The Absorption of Holland by Germany. By J. Ellis Barker.

Hungary. **Könyöki.**
A Középkori Várak különös tekintettel Magyarországra. Irta Könyöki József. Budapest, 1906. Size 11½ × 8, pp. xii. and 625. *Illustrations. Presented by the Hungarian Academy of Sciences.*
On mediæval strongholds, especially in Hungary.

Hungary—Theiss. *G. Abh.* 7 (4) (1906): pp. 76. **Vujević.**
Die Theiss. Eine potamologische Studie. Von Dr. P. Vujević. *Map and Illust.*

Iceland. **Braun.**
Ueber ein Stück einer Strandebene in Island. Von Dr. Gustav Braun. (Separat-Abdruck aus den Schriften der Physik.-ökonom. Gesellschaft, Jahrg. xlvii.) Size 10 × 7, pp. 8. *Map and Illustrations. Presented by the Author.*

Iceland. *Deutsch. Rundschau G.* 28 (1906): 289–298, 357–368. **Fester.**
Tagebuchblätter aus Island. Von G. Fester. *With Map and Illustrations.*

Iceland. *Petermanns M., Ergänzungsheft* 153 (1906): pp. 163–358 and iv. **Thoroddsen.**
Island. Grundriss der Geographie und Geologie. Von Prof. Dr. Th. Thoroddsen. II. *With Maps.* [To be reviewed.]

Italy. *Riv. G. Italiana* 13 (1906): 50–53. **Govi.**
Il Lago Scaffaiolo. Silvio Govi.

Italy. *Atti R.A. Lincei, Rendiconti* 15 (1) (1906): 462–469. **Moderni.**
Alcune osservazioni geologiche sul Vulcano Laziale e specialmente sul Monte Cavo. Nota di P. Moderni.

Italy—Arno. *M.V.E. Leipzig* (1905): 1–136. **Hunger.**
Die Schwemmlandküste des Arno. Versuch der Begrenzung eines Küstensaumes nach Innen. Von Dr. Rudolf Hunger. *With Map.*
This will be referred to in the Monthly Record.

Italy—Early Map. *B.S.G. Italiana* 7 (1906): 569–578. **Bertolini.**
Note alla Carta del Territorio Trevigiano nell' Atlante Magini del prof. G. L. Bertolini. *With Sketch-maps.*

Italy—Euganean Hills. **Marchi.**
L'idrografia dei colli Euganei nei suoi rapporti colla geologia e la morfologia della regione, del S. C. Luigi de Marchi. Venezia: Carlo Ferrari, 1905. Size 13½ × 9½, pp. 76.

Italy—Lago Deglio. *Riv. G. Italiana* 13 (1906): 193–205. **Bianchi.**
Ricerche su un laghetto alpino (il lago Deglio) del Dottore F. Bianchi. *With Map.*

Italy—Levelling. *B.S.G. Italiana* 7 (1906): 665–669. ———
Collegamento del tempio di Serapide alla livellazione geometrica di precisione e nuove determinazioni altimetriche nella regione dei Campi Flegrei. *Illustration.*
Report on the operations (see *Journal*, vol. 27, p. 86).

Italy—Railways. *Riv. G. Italiana* 13 (1906): 10–27. **Cecchini.**
La distribuzione delle ferrovie in Italia. Studio di C. Cecchini. *With Map.*

Spain—Granada. **Williams.**
Granada: Memories, Adventures, Studies, and Impressions. By Leonard Williams. London: W. Heinemann, 1906. Size 8½ × 5½, pp. xii. and 214. *Illustrations. Price 7s. 6d. net.*

Spain—History. **Clarke.**
Modern Spain, 1815–1898. By H. Butler Clarke, with a Memoir by the Rev. W. H. Hutton. (Cambridge Historical Series, edited by Dr. G. W. Prothero.) Cambridge:

The University Press, 1906. Size 7½ × 5, pp. xxvi. and 510. *Map. Price 7s. 6d. Presented by the Publishers.*

A valuable addition to this useful series.

United Kingdom—Berkshire. **Vincent.**

Highways and Byways in Berkshire. By James Edmund Vincent, with Illustrations by Frederic L. Griggs. London: Macmillan & Co., 1906. Size 8 × 5½, pp. xvi. and 444. *Maps and Illustrations. Price 6s. Presented by the Publishers.*

The author shows a keen appreciation of the charm of Berkshire scenery, and deals in a special chapter with the general characteristics of the Downs.

United Kingdom—Canals. **Pratt.**

British Canals: is their resuscitation practicable? By Edwin A. Pratt. London: J. Murray, 1906. Size 8 × 5½, pp. xii. and 160. *Maps, Diagrams, and Illustrations. Price 2s. 6d. net.*

United Kingdom—Gloucester. **Hyett.**

Gloucester in National History. By F. A. Hyett. London: Kegan Paul & Co., 1906. Size 7½ × 5, pp. xvi. and 274. *Plan and Illustrations. Price 6s. net.*

Western Europe. **Blanchard.**

Raoul Blanchard. La Flandre: Étude géographique de la Plaine Flamande en France, Belgique, et Hollande. Paris: A. Colin, 1906. Size 10 × 6½, pp. x. and 530. *Maps and Illustrations. Price 12 fr. Presented by the Publisher.*

ASIA.

Afghanistan. **Hamilton.**

Afghanistan. By Angus Hamilton. London: William Heinemann, 1906. Size 9 × 5½, pp. xxii., 562. *Map and Illustrations. Price 25s. net. Presented by the author.* [Reviewed in the December number, p. 624.]

China and Tibet. **Filchner.**

Das Rätsel des Matschu. Meine Tibet-Expedition. Von Wilhelm Filchner. Berlin: E. S. Mittler u. S., 1907 [1906]. Size 9½ × 6½, pp. xviii. and 438. *Portraits, Maps, and Illustrations. Presented by the Author.*

This will be reviewed elsewhere. The Machu of the title is the upper Hwang-ho, and must not be confounded with streams of the same name belonging to the Yang-tse system.

India. **Landon.**

Under the Sun. Impressions of Indian Cities; with a chapter dealing with the later life of Nana Sahib. By Perceval Landon. London: Hurst & Blackett, 1906. Size 9 × 6, pp. xii. and 288. *Plates. Price 12s. 6d. net. Presented by the Publishers.*

India—Bengal—Dacca. **Bradley-Birt.**

The Romance of an Eastern Capital. By F. B. Bradley-Birt. London: Smith, Elder, & Co., 1906. Size 9 × 5½, pp. x. and 350. *Map and Illustrations. Price 12s. 6d. net. Presented by the Publisher.* [To be reviewed.]

India—Botany. **Brandis.**

Indian Trees: an account of Trees, Shrubs, Woody Climbers, Bamboos, and Palms, indigenous or commonly cultivated in the British Indian Empire. By Dietrich Brandis. London: A. Constable & Co., 1906. Size 10 × 6, pp. xxxiv. and 768. *Illustrations. Price 16s. net. Presented by the Publishers.* [To be reviewed.]

India—Commercial. **Morison.**

The industrial Organization of an Indian Province. By Theodore Morison. London: J. Murray, 1906. Size 9 × 5½, pp. viii. and 328. *Diagrams. Price 10s. 6d. Presented by the Publisher.*

Malay Archipelago—Sumatra. *Petermanns M.* **52** (1906): 88–91. **Tobler.**

Zur Geologie von Sumatra. Von Dr. A. Tobler.

Malay Archipelago—Sumatra. **Van de Velde.**

Ts. K. Ned. Ard. Genoots. Amsterdam **23** (1906): 725-731.

Nota betreffende het landschap Loeboeq Ramo. Door C. Van de Velde. *With Map.*

Malay Peninsula—Ethnology. **Skeat and Blagden.**

Pagan Races of the Malay Peninsula. By William Walter Skeat and Charles Otto Blagden. 2 vols. London: Macmillan & Co., 1906. Size 9 × 6, pp. (vol. i.)

xl. and 724; (vol. ii.) xii. and 858. *Maps and Plates. Price* 42*s. net. Presented by the Publishers.* [To be reviewed.]

Malay States. **Swettenham.**

British Malaya. An Account of the Origin and Progress of British Influence in Malaya. By Sir Frank Swettenham. London: John Lane, 1906. Size 9 × 6, pp. xii. and 354. *Map and Illustrations. Price* 16*s. net. Presented by the Publisher.*

Persia. **Jackson.**

Persia Past and Present. A Book of Travel and Research. By A. V. Williams Jackson. New York: The Macmillan Co. (London: Macmillan & Co.), 1906. Size 9 × 6, pp. xxxii. and 472. *Map and Illustrations. Price* 17*s. net. Presented by the Publishers.* [Reviewed *ante*, p. 74.]

Russia—Siberia. *Ann. Hydrographie* **34** (1906): 193–219. **Herrmann.**

Die Fahrt nach dem Ob und dem Jenissei im Jahre 1905. (Zur Nordostdurchfahrt.) Bearbeitet von J. Herrmann. *With Maps and Illustrations.*

Some account of this voyage was given in the *Journal* for February, 1906 (p. 196). The present paper contains much information on hydrography, ice-conditions, etc.

Russia—Siberia. **Talko-Hryncevicz.**

Trav. Sous-Sec. Troizkossawsk-Kiakhta, S. Imp. Russ. G **7**, 1904 (1905): 36–69.

Yamarowka comme une source et sanatorium future pour la Sibérie orientale. Par J. de Talko-Hryncevicz. [In Russian.]

Siam. ——

Siam. General Report on the Operations of the Royal Survey Department, Season 1903–1904. Bangkok, 1905. Size 13½ × 8½, pp. 82. *Maps and Plates. Presented.*

Siam. **Thompson.**

Lotus Land: being an Account of the Country and the people of Southern Siam. By P. A. Thompson. London: T. Werner Laurie, 1906. Size 9 × 6, pp. xii. and 312. *Map and Illustrations. Price* 16*s. net. Presented by the Publisher.*

Siberia—Ethnology. *Abrégé B.S. Hongroise G.* **34** (1906): 37–52, 71–82. **Pápay.**

Im Lande der Nord-Ostjaken. Von Josef Pápay. [*Földrajzi Közlemények*, **34** (1906): 77–96, 172–185. *With Illustrations.*]

Siberia—Exploration. *M.V.E. Leipzig* (1905): 241–394. **Henning.**

Die Reiseberichte über Sibirien von Herberstein bis Ides. Von Dr. Georg Henning.

Tibet. **Holdich.**

Tibet the Mysterious. By Sir Thomas Holdich. ('The Story of Exploration,' edited by J. Scott Keltie, LL.D.) London: Alston Rivers, Ltd., [1906]. Size 9 × 6, pp. xii. and 356. *Maps and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publisher.* [See review, *ante*, p. 74.]

Turkey—Arabia. *Petermanns M., Ergänzungsheft Nr.* **154** (1906): pp. 80. **Auler.**

Die Hedschasbahn. Auf Grund einer Besichtigungsreise und nach amtlichen Quellen bearbeitet von Auler Pascha. *With Map and Illustrations.*

See note in the December number, p. 633.

Turkey—Asia Minor. *Z. Gletscherkunde* **1** (1906): 66–68. **Philippson.**

Ein Gletscher am Erdschias-Dagh (Argaeus) in Kleinasien. Von A. Philippson.

Turkey—Babylonia and Chaldea. **Hommel.**

Grundriss der Geographie und Geschichte des alten Orients. Von Dr. F. Hommel. Erste Hälfte: Ethnologie des alten Orients. Babylonien und Chaldäa. (Handbuch der Klassischen Altertumswissenschaft, iii. Band, i. Abt., i. Hälfte.) München: C. H. Beck, 1904. Size 10 × 7, pp. vi. and 400. *Map. Price* 7*s.* 6*d.*

Turkey—Palestine. *Palestine Expl. Fund, Q. Statement* (1906): 213–221. **Hauser.**

Cities in the Negeb, and Tribal Boundaries. By the Rev. C. Hauser.

Turkey—Syria. **Goodrich-Freer.**

In a Syrian Saddle. By A. Goodrich-Freer. London: Methuen & Co., [1905]. Size 9 × 5½, pp. 364. *Price* 7*s.* 6*d. net.*

Turkey—Syria. *Sitzb. K.P.A.W. Berlin* **1** (1906) (1): 356–363. **Sethe.**

Eine ägyptische Expedition nach dem Libanon im 15. Jahrhundert v. Chr. Von Prof. Dr. K. Sethe.

AFRICA.

Algeria. **Hilton-Simpson.**

Algiers and beyond. By M. W. Hilton-Simpson. London: Hutchinson & Co., 1906. Size 9 × 5½, pp. xii. and 296. *Map and Illustrations. Price* 12*s. net. Presented by the Author.*

Narrative of two winter journeys in the interior of Algeria, during which some more or less out-of-the-way parts were visited.

Algeria—Nomadism. **Bernard and Lacroix.**

L'Evolution du Nomadisme en Algérie. Par Prof. Augustin Bernard et Capt. N. Lacroix. Algiers: A. Jourdan (Paris: A. Challamel), 1906. Size 10 × 6½, pp. xiv. and 342. *Maps. Presented by the Authors.*

A condensed discussion by the same authors was noticed in the *Journal* for September, 1906 (p. 293).

Congo State. **Morel.**

Red Rubber: the Story of the Rubber Slave-Trade flourishing on the Congo in the Year of Grace 1906. By E. D. Morel. With an Introduction by Sir Harry H. Johnston. London: T. Fisher Unwin, 1906. Size 7 × 8, pp. xxiv. and 214. *Maps. Price* 2*s.* 6*d. net. Presented by the Publisher.*

East Africa. **Hindlip.**

Sport and Travel: Abyssinia and British East Africa. By Lord Hindlip. London: T. Fisher Unwin, 1906. Size 9 × 6, pp. 332. *Portraits. Maps and Illustrations. Price* 21*s. net. Presented by the Author.*

The most interesting sections, from a geographical point of view, are those dealing with the chain of lakes south of Abyssinia, and with Mount Elgon and its cave-dwellers.

East Africa. **Schillings.**

Der Zauber des Elelescho. Von C. G. Schillings. Leipzig: R. Voigtländer, 1906. Size 10 × 6½, pp. xiv. and 496. *Illustrations. Price* 12.50*m. Presented by the Publisher.*

The author is well known from his former work, 'Mit Blitzlichte und Buchse,' which appeared also in an English edition (see *Journal*, **25**, 554.) The present work gives a further instalment of sketches of life and nature in East Africa, again profusely illustrated by the author's photographs. Elelesho is the name of a shrub characteristic of the heart of the Masai country.

Egypt—Sinai—Archæology. **Petrie and Currelly.**

Researches in Sinai. By W. M. Flinders Petrie. With chapters by C. T. Currelly. London: John Murray, 1906. Size 10 × 7, pp. xxiv. and 280. *Maps, Plan, and Plates. Price* 21*s. net.*

Egypt and the Sudan. **Budge.**

Cook's Handbook for Egypt and the Sudan. By E. A. Wallis Budge. Second Edition. London: Simpkin, Marshall, Hamilton, Kent, & Co., Ltd., 1906. Size 7 × 4½, pp. xxii. and 911. *Maps and Illustrations. Price* 10*s. net. Presented by the Publishers.*

French Congo. **Decorse.**

(Mission Chari-Lac Tchad, 1902–1904.) Du Congo au Lac Tchad. Carnet de Route du Dr. J. Decorse. Paris: Asselin & Houzeau, 1906. Size 7 × 4½, pp. viii. and 348. *Illustration. Price* 2*s.* 4*d.*

The author was a member of the Chevalier Expedition, and carried out important ethnological and zoological researches.

French Sudan *B.S.G. Lille* **45** (1906): 379–394. **Lanrezac.**

Au pays Soudanais. Par Lieutenant Lanrezac. *With Illustrations.*

French West Africa. **Chautard.**

Étude Géophysique et Géologique sur le Fouta-Djallon (Guinée et Soudan Français). Par Jean Chautard. Paris: H. Jouve, 1905. Size 10 × 6½, pp. 210. *Maps and Illustrations. Price* 5*s.* 6*d.*

French West Africa. *Deutsch. Rundschau G.* **28** (1906): 337–343, 410–315. **Kürchhoff.**

Binnenwasserstrassen in Westafrica zwischen Senegal und Niger. Von D. Kürchhoff. *With Map.*

German East Africa. *G.Z.* **12** (1906): 241–252. **Jaeger.**

Der Meru. Von F. Jaeger. *With Illustrations.*

The author was Dr. Uhlig's companion (cf. *Journal*, vol. **25**, p. 566, and *ante*, p. 88).

German East Africa. *Deutsch. Kolonialblatt* 17 (1906): 601–611. ——
Bericht über die Tätigkeit des Detachements des Majors Johannes vom 18. November 1905 bis 10. März 1906. *With Map.*

German East Africa—Rainfall. *M. Deutsch. Schutzgeb.* 19 (1906): 164–180. **Uhlig.**
Regenbeobachtungen aus Deutschostafrika. II. Von Prof. Dr. C. Uhlig.

Italian Somaliland. *B.S.G. Italiana* 7 (1906): 669–678. **Blessich.**
L'ultima relazione sulla Somalia Italiana meridionale, del reggente capitano di corvetta G. Cerrina Ferroni. Comunicazione del A. Blessich. *With Map.*

Kamerun. *Deutsch. Kolonialblatt* 17 (1906): 457–464. **Zimmermann.**
Bericht über eine Bereisung des Mandara-Gebirges vom 16. November 1905 bis 20. Januar 1906. Von Hauptmann Zimmermann. *With Map.*

Madagascar. **Grandidier.**
Collection des Ouvrages anciens concernant Madagascar. Tome IV. Les aventures de Robert Drury pendant ses quinze années de captivité à Madagascar et son second voyage dans cette île (1701–1717 et 1719–1720). Par MM. Alfred Grandidier et Guillaume Grandidier. Paris : Comité de Madagascar, 1906. Size 10 × 6½, pp. 436. *Map and Illustration. Price* 25*s*.

Madagascar. *Questions Dipl.* 21 (1906): 727–733. ——
De Tananarive à la Mer. Le Chemin de fer du riz. *With Map.*

Madagascar. *Globus* 89 (1906): 358–362. ——
Das Volk der Tanala. *With Illustrations.*

Madagascar and East Africa. *Rev. Madagascar* 8 (1) (1906): 385–408. **Guyon.**
Le Commerce de la Côte Occidentale de Madagascar avec la Côte Est d'Afrique. Par — Guyon.

Morocco. *Archiv. Marocaines* 6 (1906): 436–456. **Confourier.**
Description géographique du Maroc d'Az-Zyâny (traduction). Par E. Confourier.

Morocco. *Questions Dipl.* 21 (1906): 785–795. **Froidevaux.**
Une mission hydrographique française au Maroc. Par H. Froidevaux. *With Map.*

Morocco. *La G., B.S.G. Paris* 13 (1906): 337–348. **Larras.**
La population du Maroc. Par N. Larras.
Noticed in the July number (p. 78).

Morocco. **Michaux-Bellaire and Salmon.**
Archiv. Marocaines 4 (1905): 1–151; 5 (1905): 1–133; 6 (1906): 219–397.
Les tribus arabes de la vallée du Lekkoûs. Par E. Michaux-Bellaire et G. Salmon. *With Illustrations.*

Morocco—Riff. *Archiv. Marocaines* 6 (1906): 398–410. **Rezzoûk.**
Notes sur le Rif. Par A. Rezzoûk.

Nigeria—Ethnology. **Leonard.**
The Lower Niger and its Tribes. By Major Arthur Glyn Leonard. London: Macmillan & Co., 1906. Size 9 × 6, pp. xxii. and 564. *Map. Price* 12*s*. 6*d*. *net. Presented by the Publishers.*

Nile Basin—Rainfall. **Lyons.**
Ministry of Finance. Survey Department, Egypt. The Rains of the Nile Basin in 1905. By Captain H. G. Lyons. Cairo, 1906. Size 11½ × 8, pp. 40. *Maps and Diagrams.*

North-East Africa. *G.Z.* 12 (1906): 277–291, 326–339. **Kürchhoff.**
Alte und neue Handelsstrassen und Handelsmittelpunkte in Nordost-Afrika. Von D. Kürchhoff.

North-East Africa—Historical. **Morié.**
Les Civilisations Africaines. Histoire de l'Éthiopie (Nubie et Abyssinie), depuis les temps les plus reculés jusqu'à nos jours. Par L.-J. Morié. 2 vols. Tome I. La Nubie (Éthiopie ancienne). Tome II. L'Abyssinie (Éthiopie moderne); avec un Appendice Diplomatique. Paris: A. Challamel, 1904. Size 7½ × 5, pp. (vol. 1) 496; (vol. 2), 514. *Price* 6*s*. 8*d*.

Portuguese East Africa—Mozambique. ——
The Companhia de Moçambique. Regulations for the Prospecting, Concession, and Working of Precious Metals and Mines in general within the territories of

Manica and Sofala, under the administration of the Companhia de Moçambique. London, [*not dated*]. Size 11 × 9, pp. xii. and 62. *Price 4s. Presented by the Companhia de Moçambique.*

Sahara. **Bernard and Lacroix.**

La Pénétration Saharienne (1830–1906). Par Augustin Bernard et N. Lacroix. Algiers: Imprimerie Algérienne, 1906. Size 10 × 6½, pp. x. and 196. *Maps. Presented by the Authors.*

Sahara. *La G.* 13 (1906): 443–446. **Villatte.**

De Ouargla au Tidikelt et vers Tombouctou. Longitudes définitives des differents points de mon itinéraire. Par N. Villatte.

South Africa. **Brown.**

The Guide to South Africa for the use of Tourists, Sportsmen, Invalids, and Settlers. Edited annually by A. Samler Brown and G. Gordon Brown for the Union-Castle Mail Steamship Co., Ltd., 1906–1907. Fourteenth Edition. London: Sampson Low, Marston & Co., [*not dated*; 1906]. Size 7½ × 5, pp. lxiv. and 477. *Maps and Plans. Price 2s. 6d. Presented by the Publishers.*

This excellent guide continues to receive a yearly revision, bringing it well up to date. The first part consists of general information on a great variety of topics, including both practical directions for travellers and sections on climate, physical geography, resources, etc. The second part describes routes through the country, with statistics of the places touched at.

South Africa. *Quarterly J.R. Met. S.* 32 (1906): 177–188. **Mill.**

South Africa as seen by a Meteorologist during the Visit of the British Association in 1905. By Dr. H. R. Mill. *With Illustrations.*

South Africa—Boundary. **Gill and others.**

Report on the Boundary Survey between British Bechuanaland and German South-West Africa executed by Lieut.-Colonel Laffan, R.E., Commissioner on behalf of Great Britain, and Lieut. Wettstein, and later by Oberlieutenant Doering, Commissioners on behalf of Germany, under the direction of Sir David Gill. [In English and German.] Berlin: E. S. Mittler & Sohn, 1906. Size 13½ × 8½, pp. viii. and 162. *Map and Diagrams. Presented by the Secretary of State for the Colonies.*

West Africa—Anthropology. **Dennett.**

At the back of the Black Man's mind; or, Notes on the Kingly Office in West Africa. By R. E. Dennett. London: Macmillan & Co., 1906. Size 9 × 6, pp. xvi. and 288. *Illustrations. Price 10s. net. Presented by the Author.*

NORTH AMERICA.

Canada—Labrador. **Wallace.**

The Lure of the Labrador Wild. The Story of the Exploring Expedition conducted by Leonidas Hubbard, junr. By Dillon Wallace. London: Hodder & Stoughton, 1905. Size 8½ × 5½, pp. 340. *Maps and Illustrations. Price 7s. 6d.*

Canada—Rocky Mountains. **Hornaday.**

Camp Fires in the Canadian Rockies. By Dr. William T. Hornaday. Illustrations by John M. Phillips. London: T. Werner Laurie, 1906. Size 9½ × 6, pp. xx. and 354. *Maps and Illustrations. Price 16s. net. Presented by the Publisher.*

Canada—Rocky Mountains. **Outram.**

In the Heart of the Canadian Rockies. By James Outram. New York: The Macmillan Co. (London: Macmillan & Co.), 1905. Size 9 × 6, pp. xiv. and 466. *Maps and Illustrations. Price 12s. 6d. net.*

Mexico—Minerals. **Martin.**

Mexico's Treasure-house (Guanajuato). An Illustrated and Descriptive Account of the Mines and their Operations in 1906. By Percy F. Martin. New York; The Cheltenham Press, 1906. Size 9½ × 6, pp. 260 and x. *Map, Diagram, and Illustrations. Presented by the Author.*

United States. *Science* 23 (1906): 865–869. **Hough.**

Pueblo Environment. By Dr. Walter Hough.

United States—California. *National G. Mag.* 17 (1906): 325–343. ——

The California Earthquake.

A series of illustrations showing the damage done by the earthquake.

United States—California. *Rev. Française* 31 (1906): 375–384. **Chanel.**
Les origines de San Francisco et la découverte de l'or. Par C. Chanel.

United States—California. *Scottish G. Mag.* 22 (1906): 430–434. **Dixon.**
Concerning the Great Californian Disaster. By Prof. J. M. Dixon. *With Map.*

United States—California. *Popular Sci. Monthly* 68 (1906): 333–335. **Macbride.**
Making Geography while you wait. By T. H. Macbride. *With Map.*

On the recent inundation of the Salton basin by the Colorado. (Cf. note in the June number, p. 632.)

United States—California. *J. Geology* 14 (1906): 303–315. **Taber.**
Some local effects of the San Francisco Earthquake. By S. Taber. *With Maps and Illustrations.*

United States—Historical. **Joutel.**
Joutel's Journal of La Salle's Last Voyage, 1684–7. . . . New Edition with Historical and Biographical Introduction, Annotations and Index by Henry Reed Stiles; to which is added a Bibliography of the Discovery of the Mississippi, by Appleton P. C. Griffin. Albany, N.Y.: Joseph McDonough, 1906. Size 9½ × 7, pp. 258. *Facsimile Map and Plate. Price $5 net.*

Forms the concluding volume of the series planned by Dr. Shea, and of which the two first volumes (see below) appeared in 1852 and 1861 respectively. The present work is a reprint, with editorial additions, of the English version of 1714.

United States—Historical. **Shea.**
Discovery and Exploration of the Mississippi Valley, with the Original Narratives of Marquette, Allouez, Membré, Hennepin, and Anastase Douay. By John Gilmary Shea. Second Edition. Albany: Joseph McDonough, 1903. Size 9½ × 7, pp. lxxx. and 268. *Facsimile Map and Portrait. Price $5 net.*

Reprint, in excellent style, of the edition of 1852, with the addition of a facsimile of Marquette's original map and letter, and a steel portrait of La Salle.

United States—Historical. **Shea.**
Early Voyages up and down the Mississippi. By Cavelier, St. Cosme, Le Sueur, Gravier, and Guignas. With an Introduction, Notes, and an Index, by John Gilmary Shea. Albany: Joel Munsell, 1861. [Joseph McDonough, 1902.] *Price $4 net.*

An exact reprint of the edition of 1861, supplementary to the volume issued in 1852 (see above).

United States—Immigration. **Hall.**
American Public Problems. Immigration and its effects upon the United States. By Prescott F. Hall, LL.D. New York: H. Holt & Co. (London: G. Bell & Sons), 1906. Size 7½ × 5, pp. xiv. and 394. *Price 6s. net. Presented by Messrs. G. Bell & Sons.* [To be reviewed.]

United States—Industries. *B.S.G. Philadelphia* 4 (1906): 37–50. **Surface.**
The Industrial Situation in the South: A Study in Economic Geography. By G. T. Surface.

United States—Kentucky. **Ashley and Glenn.**
Geology and Mineral Resources of part of the Cumberland Gap Coal Field, Kentucky. By G. H. Ashley and L. C. Glenn. (U.S. Geological Survey, Professional Paper No. 49.) Washington, 1906. Size 11½ × 9, pp. 240. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—Mississippi River. *B. American G.S.* 38 (1906): 349–354. **Brown.**
The Mississippi River as a Trade Route. By R. M. Brown.

United States—New York. *B. American G.S.* 38 (1906): 355–365. **Hubbard.**
Drumlinoids of the Catatonk Folio. By G. D. Hubbard. *With Illustrations.*

United States—North Carolina. *National G. Mag.* 17 (1906): 310–317. **Cobb.**
Where the Wind does the Work. By C. Cobb. *With Map and Illustrations.*

United States—Ohio. **Hulbert.**
The Ohio River: a Course of Empire. By Archer Butler Hulbert. New York and London: G. P. Putnam's Sons, 1906. Size 9½ × 6½, pp. xvi. and 378. *Maps and Illustrations. Price 15s. net. Presented by the Publishers.*

One of a series of works issued by the same publishers, dealing with some of the most famous rivers of North America. The part played by the Ohio in the history of the United States is well brought out.

CENTRAL AND SOUTH AMERICA.

Central America. **Wilda.**

Amerika-Wanderungen eines Deutschen. Von Johannes Wilda. I. In der Mitte des Kontinents. Zweite Auflage. Berlin: Allgemeiner Verein für Deutsche Literatur, 1906. Size 9 × 6, pp. viii. and 368. *Map and Illustrations. Price* 6*s.*

Gives a good deal of information on the present economic position in the Central American States.

Central and South America. **Pepper.**

Panama to Patagonia. The Isthmian Canal and the West Coast Countries of South America. By C. M. Pepper. London: Hodder & Stoughton, 1906. Size 9 × 6, pp. xx. and 398. *Maps and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Discusses the bearings of the making of the Panama canal on the economic development of Western South America, besides giving useful general information on the countries in question.

Colombia. *Int. Amerikanisten-Kongress* **14** *Tag.* **1904, (1906): 517–520.** **Regel.**

Die Reste der Urbevölkerung (Indios bravos) in der Kolumbischen West-Kordillere nach eigenen Beobachtungen im Jahre 1896. Von Prof. Dr. F. Regel.

Ecuador. **Meyer.**

In den Hoch-Anden von Ecuador: Chimborazo, Cotopaxi, etc. Reisen und Studien von Prof. Dr. Hans Meyer. Berlin: Dietrich Reimer, 1907 [1906]. Size 10 × 7, pp. 14* and 552. *Maps and Plates. Price* 15 *marks. Presented by the Publisher.* [To be reviewed.]

Haiti—Meteorology. *Monthly Weather Rev.* **34** (1906): 64–73. **Talman.**

Climatology of Haiti in the Eighteenth Century. By C. F. Talman. *With Map.*

Mexico and Central America. *Globus* **89** (1906): 149–152. **Sapper.**

Der Einfluss des Menschen auf die Gestaltung des mexikanisch-mittelamerikanischen Landschaftsbildes. Von Karl Sapper.

Montserrat. **Watts.**

Report on the Agricultural Industries of Montserrat. By Francis Watts, C.M.G., D.SC. Colonial Reports, Miscellaneous, No. 34, 1906. Size 10 × 6, pp. 16. *Diagram. Price* 2½*d.*

Panama—Tides. *Monthly Weather Rev.* **34** (1906): 80–81. **Harris.**

Early knowledge of the tides at Panama. By R. A. Harris.

Paraguay River. *B.I.G. Argentina* **22** [Part 2]: 154–158. **Decoud.**

Las Crecientes del Rio Paraguay. Por José Segundo Decoud.

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. **Plate.**

The "Lloyd" Guide to Australasia, edited by A. G. Plate for the Norddeutscher Lloyd, Bremen. London: E. Stanford, 1906. Size 7 × 4½, pp. 470 and x. *Maps, Plans, and Illustrations. Price* 6*s. Two copies, presented by the Publisher and Mr. Rex Davies.*

A handbook of the kind for Australasia has not hitherto been in existence. This volume will therefore be of much practical use to travellers in that part of the world.

Australia—Ethnology. **Thomas.**

The Native Races of the British Empire. Natives of Australia. By N. W. Thomas. London: A. Constable & Co., 1906. Size 9 × 5½, pp. xii. and 256. *Map and Illustrations. Price* 6*s. net. Presented by the Publisher.*

One of a series, treating of the native races of various parts of the empire.

New Zealand. *B. American G.S.* **38** (1906): 273–281. **Bell.**

A Physiographic Section through the Middle Island of New Zealand. By J. M. Bell. *With Maps and Illustrations.*

New Zealand. **Elkington.**

Adrift in New Zealand. By E. Way Elkington. London: John Murray, 1906. Size 8½ × 6, pp. xii. and 276. *Illustrations. Presented by the Publisher.*

A pleasantly written and excellently illustrated account of experiences in New Zealand during seven years' residence, by an enthusiastic admirer of the country.

New Zealand—Botany. **Cheeseman.**

Manual of the New Zealand Flora. By T. F. Cheeseman. Published under the authority of the Government of New Zealand. Wellington, 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. xxxvi. and 1200. *Presented by the Minister of Education, N.Z.*

Opens with an outline of the history of botanical discovery in New Zealand, the bulk of the volume consisting of systematic descriptions of the plants.

Pacific Ocean. **Downing.**

The Total Solar Eclipse of 1908, January 3. By A. M. W. Downing. (Monthly Notices of the Royal Astronomical Society, March, 1906.) Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. [4]. *Plans. Presented by the Author.*

On the two islands, Flint and Hull, favourably placed for observing the eclipse.

Samoa. *Globus* **90** (1906): 21–24. **Bülow.**

Die vulkanische Tätigkeit auf Savaii und deren Einwirkung auf die wirtschaftlichen Verhältnisse der Eingeborenen. Von W. v. Bülow. *With Map and Illustrations.*

Samoa. *Petermanns M.* **52** (1906): 86–88. **Reinecke.**

Der Vulkan auf Savaii. Von Dr. F. Reinecke.

Samoa. *Deutsch. Kolonialzeitung* **23** (1906): 273–276. **Deeken.**

Ein neuer Vulkan im Stillen Ozean. Von Richard Deeken. *With Illustrations.*

POLAR REGIONS.

Arctic. ——

A Canadian for the Pole. How Captain Bernier would take possession of our northern heritage. (From *Canadian Life and Resources*, Montreal, January, 1906, pp. 6–7, 21–22.) Size $14\frac{1}{2} \times 10\frac{1}{2}$. *Map and Illustrations.* [See *ante*, p. 93.]

Arctic. **Garde.**

The State of the Ice in the Arctic Seas, 1905. Prepared by V. Garde. (From the Nautical-Meteorological Annual of the Danish Meteorological Institute.) [In English and Danish.] [Copenhagen, 1906.] Size $12\frac{1}{2} \times 9\frac{1}{2}$, pp. xx. *Charts.*

Arctic—Oceanography. **Bøggild and Others.**

On the Bottom Deposits of the North Polar Sea. By O. B. Bøggild. With Appendix I.: Analyses of the Bottom Deposits, by O. Heidenreich and C. J. J. Fox. Appendix II.: Thalamophora of the Bottom Deposits and the Mud from the Ice Surface, by H. Kiær.—(The Norwegian North Polar Expedition, 1893–1896: Scientific Results. Vol 5, xiv., pp. 1–62. London: Longmans & Co., 1906.) *Map and Diagrams.*

Arctic—Wellman Expedition. *C.R.A. Sc.* **142** (1906): 1177–1179. **Janssen.**

Sur une expédition en ballon dirigeable, projetée pour l'Exploration du Pôle Nord. Note de M. J. Janssen.

MATHEMATICAL GEOGRAPHY.

Astronomy. **Moulton.**

An Introduction to Astronomy. By Dr. Forest Ray Moulton. New York and London: Macmillan, 1906. Size $7\frac{1}{2} \times 5\frac{1}{2}$, pp. xx. and 558. *Maps, Illustrations, and Diagrams. Price 5s. net. Presented by the Publishers.*

An excellent outline of present-day knowledge of the subject.

Geodesy. **Krüger.**

Zur Ausgleichung der Widersprüche in den Winkelbedingungsgleichungen trigonometrischer Netze. Von L. Krüger. (Veröffentlichung des Königl. Preussischen Geodätischen Institutes N.F., No. 25.) Potsdam; Leipzig: B. G. Teubner, 1906. Size $11\frac{1}{2} \times 9\frac{1}{2}$, pp. 34.

Planimetry. *Z. Ges. Erdk. Berlin* (1906): 152–176, 233–256. **Schmiedeberg.**

Zur Geschichte der geographischen Flächenmessung bis zur Erfindung des Planimeters. Von Dr. W. Schmiedeberg.

See note in the *Journal* for October, 1906 (p. 405).

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology. *J. Geology* **14** (1906): 226–232. **Sardeson**

The Folding of Subjacent Strata by Glacial Action. By F. W. Sardeson. *With Illustrations.*

Geomorphology. **Cholnoky.**
Die Verteilung des Niederschlags als Ursache eines wichtigen geophysischen Vorganges. Von Dr. Eugen v. Cholnoky. (From the *Abrégé du Bulletin de la Société Hongroise de Géographie*, vol. 31, 1903). Size 9½ × 6¼, pp. [9].

Geomorphology—Valleys. *B.G.S. Philadelphia* 4 (1906): 1-11. **Davis.**
Incised Meandering Valleys. By W. M. Davis. *With Diagrams.*
See note in Vol. 28, p. 514.

Geophysics. *P.R.S.*, Ser. A. 77 (1906): 472–485. **Strutt.**
On the Distribution of Radium in the Earth's Crust, and on the Earth's Internal Heat. By the Hon. R. J. Strutt. *With Diagrams.*

Geophysics—Movement of the Pole. *Ymer* 26 (1906): 175–180. **Rosén.**
Nordpolens rörelse. Af A. P. Rosén. *With Diagram.*

Glacial Epoch. **Geinitz.**
Die Eiszeit Von Dr. F. E. Geinitz. (Die Wissenschaft . . . Sechzehntes Heft.) Braunschweig: F. Vieweg und Sohn, 1906. Size 8½ × 5½, pp. xiv. and 198. *Maps and Illustrations. Price 7 marks. Presented by the Publishers.*

Glaciation. **Gugenhan.**
Die Vergletscherung der Erde von Pol zu Pol. Von Max Gugenhan. Berlin: R. Friedländer & Sohn, 1906. Size 10½ × 7, pp. viii. and 200. *Sketch-maps, Illustrations, and Diagrams. Price 8s.*

Glaciers. *Z. Gletscherkunde* 1 (1906): 4-20. **Blümcke and Finsterwalder.**
Die Gletscherbewegung mit Berücksichtigung ihres senkrechten Anteiles. Von A. Blümcke und S. Finsterwalder. *With Map.*

Glaciers. *C.R.A. Sc.* 142 (1906): 1234–1235. **Brunhes.**
Sur les contradictions de l'érosion glaciaire. Note de M. Jean Brunhes.

Glaciers. *C. Rd.* 142 (1906) 1299–1301. **Brunhes.**
Sur une explication nouvelle du surcreusement glaciaire. Note de J. Brunhes.
The writer holds that the excavation of glacier-filled valleys is due to the action of the sub-glacial torrents, not to that of the ice itself, and that the typical forms presented by such valleys are the result of the special distribution of the water beneath the ice, principally on the two sides.

Meteorology. **Bigelow.**
U.S. Department of Agriculture, Weather Bureau. Studies on the diurnal periods in the lower strata of the atmosphere. (Reprints from the *Monthly Weather Review*, February, March, April, May, July, and August, 1905.) By F. H. Bigelow. Washington, 1905. Size 11½ × 9½, pp. 52. *Illustrations and Diagrams.*

Meteorology. *Science* 23 (1906): 672-674. **Fergusson.**
Meteorological Phenomena on Mountain Summits. By S. P. Fergusson.

Meteorology—Aurora. *C. Rd.* 142 (1906): 1330-1333. **Villard.**
Sur l'Aurore boréale. Note de P. Villard.

Meteorology—Mirage. *Globus* 89 (1906): 245-246. **Aulagen.**
Zur Frage der Luftspiegelungen. Von Prof. Dr. Otto Aulagen.

Meteorology—Mirage, etc. *Ann. Hydrographie* 34 (1906): 181-182. **Graff.**
Spiegelungs- und Refraktionserscheinungen an der See. Von Dr. K. Graff. *Plate.*

Meteorology—Pressure. *P.R.S.*, Ser. A, 78 (1906): 43-60. **Lockyer.**
Barometric Variations of Long Duration over Large Areas. By W. J. S. Lockyer, PH.D. *With Diagrams.*

Meteorology—Wind. **Ficker.**
Innsbrucker Föhnstudien. I. Beiträge zur Dynamik des Föhns. Von Heinz von Ficker. (Besonders abgedruckt aus dem lxxviii. Bande der Denkschriften der Mathematisch-Naturwissenschaftlichen Klasse der Kaiserlichen Akademie der Wissenschaften.) Wien: Karl Gerold's Sohn, 1905. Size 12¼ × 9¼, pp. 82. *Diagrams.*

Meteorology and Oceanography. **Van der Stok.**
Ts. K. Ned. Aard. Genoots. Amsterdam 23 (1906): 681-712.
Wind en Water. Door Dr. J. P. Van der Stok. *With Diagrams.*
Deals, among other subjects, with the influence of the wind on ocean currents.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Reclus.**

Élisée Reclus. L'Homme et la Terre. Tome Deuxième. Histoire Ancienne. Phénicie—Palestine—Égypte—Libye—Grèce—Isles et rivages helléniques—Rome. Paris: Librarie Universelle, [1905]. Size 11 × 8¼, pp. 572. *Maps and Illustrations. Price* 15 *fr. Presented by the Publishers.*

Anthropology. **Pitt-Rivers.**

The Evolution of Culture, and other Essays. By Lieut.-General A. Lane-Fox Pitt-Rivers. Edited by J. L. Myres, with an introduction by Henry Balfour. Oxford: the Clarendon Press, 1906. Size 9 × 6, pp. xx. and 232. *Illustrations and Map. Price 7s. 6d. net. Presented by the Publishers.*

Students will welcome the appearance of a new edition of these essays, which have long been out of print. Verbal errors and misquotations have been corrected, and full references to authorities supplied. The essays date from various years between 1867 and 1874, and are important as the outcome of the first systematic attempt to trace the evolution of the products of human handiwork.

Commercial Geography—Communications. *M. V.E. Leipzig* (1905): 137–240. **Dressler.**

Fusspfad und Wege geographisch betrachtet. Von Dr. Georg Dressler. *With Map and Illustrations.*

Economic—Irrigation, etc. **Cox.**

Irrigation with surface and subterranean waters and Land Drainage, with special reference to the geological development and utilisation of artesian and sub-artesian supplies. By W. Gibbons Cox. Sydney: Angus & Robertson, 1906. Size 7½ × 5, pp. viii. and 298. *Map and Illustrations. Price 6s. Presented by the Author.*

Historical. *Monthly Rev.* **24** (1906): 121–137. **Blind.**

Homeric knowledge of the High North. The Tale of Kirkê and Holda Hirkê. By K. Blind.

Historical—Cartography. *Abrégé B.S. Hongroise G.* **34** (1906): 53–55. **Teleki.**

Nachricht über die soeben entdeckte Ähnlichkeit des Globus von Rouen und der Karte Gastaldis? v. J. 1554. Von Paul, Graf Teleki. *With Plate.* [*Földrajzi Közlemények* **34** (1906): 107–109.]

Points out the almost complete identity in the legends and delineations of these two cartographical documents.

Historical—Columbus. **Vignaud.**

Sophus Ruge et ses vues sur Colomb. Par H. Vignaud. (Extrait du *Journal de la Société des Américanistes de Paris*, N.S., t. iii. No. 1.) 1906. Size 11½ × 8, pp. 10. *Presented by the Author.*

Historical—Exploration. **Lee.**

The World's Exploration Story. By Albert Lee. London: A. Melrose, 1906. Size 8½ × 5½, pp. xii. 338. *Illustrations. Price 5s. Presented by the Author.*

A popular account of the main episodes in the history of geographical discovery.

History of Geography. **Beazley.**

The Dawn of Modern Geography, vol. 3. A History of Exploration and Geographical Science from the middle of the Thirteenth to the early years of the Fifteenth Century (*c.* A.D. 1260–1420). By C. Raymond Beazley. Oxford: the Clarendon Press, 1906. Size 9 × 6, pp. xvi. and 638. *Maps. Price 20s. Presented by the Publishers.* [Reviewed *ante*, p. 81.]

BIOGRAPHY.

Bishop. **Stoddart.**

The Life of Isabella Bird (Mrs. Bishop). By Anna M. Stoddart. London: John Murray, 1906. Size 9 × 6, pp. xii. and 416. *Maps and Illustrations. Price 18s. net. Presented by the Publisher.*

Bunbury. **Lyell.**

The Life of Sir Charles J. F. Bunbury, Bart., with an Introductory Note by Sir Joseph Hooker. Edited by Mrs. Henry Lyell. 2 vols. London: J. Murray, 1906. Size 9 × 5½, pp. (vol. 1) xii. and 372; (vol. 2) 412. *Portraits and Illustrations. Price 30s. net. Presented by the Publisher.*

Richter. *M.K.K.G. Ges. Wien* **49** (1906): 161–255. **Marek.**
Eduard Richters Leben und Wirken. Von Prof. Dr. R. Marek.

Wissmann. *Z. Kolonialpolitik, etc.* **8** (1906): 355–374. **Schmidt.**
Die Bedeutung Hermann von Wissmann's in der Entdeckungsgeschichte Afrikas und in Deutschlands Kolonialgeschichte. Von Rochus Schmidt.

GENERAL.

British Empire. **Dove.**
Das britische Weltreich. Eine wirtschaftsgeographische Untersuchung. Von Dr. K. Dove. (Die angelsächsischen Reisenreiche, I.) Jena: H. Costenoble, 1906. Size 9½ × 6½, pp. 96. *Price* 2*m*. 50. *Presented by the Publisher.*

British Empire. **Kirkpatrick.**
Lectures on British Colonization and Empire. First Series (1600–1783). By F. A. Kirkpatrick, with an Introduction by H. E. Egerton. London: J. Murray, 1906. Size 8 × 5½, pp. xvi. and 116. *Price* 2*s*. 6*d*. *Presented by the Publisher.*

Earth-Sciences. **Hubbard.**
Physiography and Geography: their relations, differences, and essential fields. By Geo. D. Hubbard. (Read at the Cincinnati meeting, Ohio G. Acad. of Sci., Dec. 2, 1905.) Size 9½ × 6, pp. [5].

The writer's attempt to draw a dividing line between the subjects is somewhat vitiated by the absence of unanimity regarding the employment of the former term, which he naturally uses in the sense confined to the United States.

Educational. *G. Teacher* **3** (1906): 161–164. **Gallois.**
The Material Equipment for teaching Geography in the French Schools. By Dr. L. Gallois.

Educational. *Nineteenth Century* **60** (1906): 632–646. **Macnaghten.**
Geography in our Public Schools. By R. E. Macnaghten.

Educational. *J.G.* **5** (1906): 66–73. **Whitbeck.**
The Fundamental and the Incidental in Geography. By R. H. Whitbeck.

Educational—Text-book. **Herbertson.**
The Oxford Geographies. Vol. 1. The Preliminary Geography. By Dr. A. J. Herbertson. Oxford: The Clarendon Press, 1906. Size 7½ × 5, pp. viii. and 149. *Maps and Diagrams.* *Price* 1*s*. 6*d*. *Presented by the Publishers.* [To be reviewed.]

World. **Moncrieff.**
The World of To-Day. A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. Hope Moncrieff. Vol. 6. London: The Gresham Publishing Co., 1906. Size 11 × 7½, pp. vi. and 380. *Maps, Illustrations, and Diagrams.* *Price* 8*s*. *net.* *Presented by the Publishers.*

This work is now completed (cf. *Journal*, **25**, 696).

OLDER WORKS ADDED TO THE LIBRARY AND MAP COLLECTION IN 1906.

BOOKS.

Alberti, Leandro.—Descrittione di tutta Italia. Size 11½ × 8. *Bologna*, 1550

Arvieux.—The Chevalier d'Arvieux's Travels in Arabia the Desart. *Plates.* Size 6½ × 4. *London*, 1723

Botero, Giovanni.—Le Relationi Universali di. Size 8 × 5. *Bergamo*, 1596

Drake.—Sir Francis Drake revived. 4 parts in one vol. *Portrait.* Size 7½ × 5½. *London*, 1653

Frankland, Charles.—Travels to and from Constantinople, 1827–28. 2 vols. *Maps and Plates.* Size 9 × 5½. *London*, 1829

Heron, Robert.—A Journey through the Western Highlands of Scotland. 2 vols. *Plates.* Size 8½ × 5½. *Perth*, 1793

James, J. T.—Journal of a Tour in Germany, etc. 2 vols. *Plates.* Size 8½ × 5½. *London*, 1819

Martinelli, Fioravante.—Roma ricercata nel suo sito. *Woodcuts.* Size 7 × 4½. *Rome*, 1761

Mitchell.—Five MS. vols. describing Journeys to Rome and Naples, 1817, and the Topography of parts of Palestine and Syria. *Maps and Plates.* Size 13¾ × 8½.

Salmon.—Geographical and Astronomical Grammar. *Maps.* Size 9 × 5½. *London*, 1785

S——, P. P. v.—De seldsaame en noit gehoorde Wal-Vis-Vangst. *Illustrations.* Size 8 × 6. (*Presented by Sir Martin Conway.*) *Leyden*, 1684

Verona.—Descrizione di Verona e della sua provincia. 2 vols. *Maps and Illustrations* Size 8½ × 6. *Verona*, 1820-21

ATLASES AND MAPS.

Bradshaw, G.—Map of canals situated in the Counties of Lancaster, York, Derby, and Chester. *Manchester*, 1830

——————Map of canals, navigable rivers, railroads, etc., in the Midland Counties of England. [*Manchester*, 1830]

Homann, J. B.—Atlas Novus Terrarum Orbis Imperia Regna et Status exactis tabulis geographicé demonstrans. *Nuremburg*, [N.D.]

Mogg, E.—New map of the Country twenty-four miles round London. *London*, 1809

Olivieri, B.—Veduti degli avanzi dei monumenti antichi delle due Sicilie. [*Vol. of Plates.*] Size 9½ × 15. *Rome*, 1794

Waghenaer, L. J.—Speighel der Zeevaerdt, van de navigatie der Westersche Zee, innehoudende alle de Custe(n) va(n) Vranckrijck, Spaignen en(de) t'principælste deel van Engelandt. 2 vols. in 1. *Leyden*, 1584–85

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from November 1 to 30, 1906.

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36 N.E., 37 S.W., 44 S.W., S.E., 47 S.E., 48 N.E., 56 N.W., 57 N.E., 58 N.W., 59 N.W., N.E., 68 N.E., 72 N.W., S.W., 81 N.E., 84 N.E., S.E., 86 N.E., 94 N.E. **Yorkshire** (First Revision of 1891 Survey), 281 S.E., 282 S.W. 1*s. each.*

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These are new editions.

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilung der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 294, Schöneberg; 268, Charlottenberg. Berlin: K. Preussische Landesaufnahme, 1905-6. *Price* 1.50*m. each sheet.*

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ASIA.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Bearbeitet von Dr. Richard Kiepert. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Sheet A. II. Constantinopel. Berlin: Dietrich Reimer, 1906. *Price* 6*m. each sheet.*

Includes the Bosporus, with Constantinople, the gulf of Ismid and the Black sea coast to about 20 miles to the east of the river Sakaria.

Caucasus. **Déchy.**

Karte des kaukasischen Hochgebirges und der angrenzenden Gebiete von Cis- und Trans-Kaukasien. Bearbeitet von Moriz von Déchy. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. 2 Sheets. Berlin: Dietrich Reimer; Vienna: Freytag & Berndt. *Presented by the Author.*

This map accompanies M. de Déchy's recent work, 'Reisen und Forschungen im kaukasischen Hochgebirge,' and has been compiled from the Russian Staff maps, combined with the author's own photographic surveys and observations, which, as is well known, have extended over many years. It will be chiefly useful from the fact that it practically comprises the whole range of the Caucasus from the Black sea to the Caspian; but for the central part of the range it is likely to be a long time before a general map is produced that will supersede that published by Mr. D. W. Freshfield in his 'Exploration of the Caucasus,' which is on a larger scale, and decidedly clearer in glacier detail.

M. de Déchy's map consists of two lithographed sheets, each measuring 21 × 38 inches. It is in three colours—roads, lettering, etc., black; hillwork, brown; and glaciers, rivers, and seas, blue. Whilst on the whole the general effect of this combination is fairly good, on closer examination the map will be found to be somewhat disappointing as regards detail, the ranges and spurs in many districts being sadly lacking in relief, and the smaller names in places indistinct.

AFRICA.

Egypt. **Egyptian Survey Department.**

Provisional map of a portion of the Eastern Desert of Egypt. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 11 E, 11 F, 12 E, 12 F, 15 E, 15 F. Giza: Survey Department, 1906. *Presented by the Director-General, Survey Department, Giza.*

These sheets include the region lying approximately between 24° to 26° N. lat. and 33° to 34° E. long.

Italian Somaliland. **Rossetti.**

Schizzo dimostrativo della Somalia Italiana Settentrionale redatto da Carlo Rossetti. Scale 1 : 3,500,000 or 1 inch to 55·2 stat. miles. Rome: G. De Agostini & Co., 1906. *Presented by the Author.*

A little general sketch-map of the northern part of Italian Somaliland, including also British Somaliland. It is accompanied by text giving general and statistical information on this region and its inhabitants, followed by a bibliography of the books and maps, which, however, is by no means as complete as it might be.

Italian Somaliland. **Rossetti.**

Schizzo dimostrativo della Colonia del Benadirredatto da Carlo Rossetti. Scale 1 : 2,500,000 or 1 inch to 39·5 stat miles. Roma: G. De Agostini & Co., 1906. *Presented by the Author.*

Natal. **Surveyor-General, Natal.**

Map of the Colony of Natal. Compiled in the Surveyor-General's Office, Natal, from diagrams and general plans therein, and from data furnished by the Engineer-in-Chief for Railways, and by the Chief Engineer, Public Works Department. Scale 1 : 253,440 or 1 inch to 4 stat. miles. 4 sheets. Pietermaritzburg: Surveyor-General's Office, 1904. *Presented by the Agent-General for Natal.*

Until a regular triangulation of the whole of Natal is completed, upon which topographical maps can be based with certainty, all maps of the colony must be more or less unsatisfactory, and can only be compiled from such material as exists in the Surveyor-General's office, the plans of railway engineers, and other disjointed cartographical information of varying degrees of dependency.

It is from such data that this map has been compiled; and under the circumstances it is certainly a creditable production, containing a large amount of detailed information. With the exception of the Reserve boundaries, which are in red, the map is in black only, but is very clearly printed, so that the hill features, which are chalked, do not obliterate the lettering.

North-East Africa. **Rossetti.**

Schizzo dimostrativo delle vie di comunicazione fra l'Eritrea, il Sudan e l'Etiopia, redatto da Carlo Rossetti. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Rome: G. De Agostini & Co., [1906]. *Presented by the Author.*

Shows by colours and symbols roads and railways under construction and proposed.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet LXII. Mahrès. Paris: Service Géographique de l'Armée, [1906]. *Price* 1.20 *fr. each sheet.*

AMERICA.

Brazil. **Payer.**

Rio Jauapery (Brasilien). Nach eigenen Aufnahmen in den Jahren 1900 u. 1901 von Richard Payer. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. *Petermanns Mitteilungen*, Jahrgang 1906, Tafel 15. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet 18, Wood Mountain, revised to October 3, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Ottawa.**

Map of Manitoba, Saskatchewan, and Alberta. Scale 1 : 792,000 or 1 inch to 12·5 stat. miles. Special edition showing even-numbered sections finally disposed of. Third edition, corrected to May 1, 1906. 3 sheets. Ottawa: Department of the Interior, 1906. *Presented by the High Commissioner for Canada.*

This is the third edition of a map mentioned in the *Geographical Journal* for November, 1905, corrected up to May 1, 1906. The information as to the limits of prairie, partly prairie or park country, and wooded land, is only approximate.

Chile. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: Llanquihue; Magallanes. Santiago: Oficina de Limites, [1906]. *Presented by the Director, Oficina de Limites, Santiago.*

As is the case with the others of this series, each topographical sheet is accompanied by a sheet showing the traverse and triangulation lines upon which the former is based. In addition to the work of the Chilian Boundary Commission, the charts of the Chilian Hydrographic Office, and surveys of the Argentine Boundary Commission, as well as other cartographical data, have been utilized in order to complete the sheets.

South America—Acre Territory. **"Petermanns Mitteilungen."**

Karto des Acre-Gebiets. Kompiliert nach dem gesammten neuern material. Scale 1 : 2,500,000 or 1 inch to 39·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1906, Tafel 16. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Parts xiv. and xv. London: George Newnes, Limited, 1906. *Price 6d. each part. Presented by the Publisher.*

Part 14 contains a continuation of the Introduction to Economic Geography, after which are given the following plates of maps and diagrams: 5, World Rainfall, Winds, and Diseases; 6, 7, World, showing Density of Population, with special maps of the distribution of population of the United States, India, and Europe; 8, World, showing Prevailing Races and Religions; 9, Principal Languages of the World; 10, 11, World, showing Commercial Development; 12, Comparative Population and Wealth of the World. The commercial development map of the world is specially interesting.—Part 15 contains the first section of a Commercial Gazetteer of Countries and Ports, followed by Plates; 13, Wealth and Population of the British Isles; 14, 15, and 16, Political maps of the World, showing British Consulates, Imports, and Export Trade of States; 25, International Railways; 26, 27, British Naval Chart and Strength of National Navies of the World; 28, Isochronic Travel Lines, Tariff Chart. Many of these maps are on a very small scale, and the information they contain has necessarily been much generalized. The Isochronic Distance Chart gives the days occupied in reaching various parts of the world, presumably from London, but it is not stated what is the exact point of departure, and, indeed, it is only to be assumed that the distances are from England at all.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and 105,000 references. Part 8, containing plates 17–18, the British Isles (physical); 55–56, Germany, Industries and Communications; 99–100, Asia (general map). London: The Amalgamated Press, Limited, 1906. *Price 7d. each part.*

World. **Schrader.**

L'Année Cartographique. Supplément annuel à toutes les publications de Géographie et de Cartographie. Dressé et rédigé sous la direction de F. Shrader. Seizième année contient les modifications géographiques et politiques de l'année 1905. Paris: Hachette et Cie., 1906. *Price 3 fr. Presented by the Publisher.*

This is the sixteenth issue of M. F. Schrader's useful annual, 'l'Année Cartographique,' and contains a brief record of the principal exploratory and surveying expeditions, together with modifications to international boundaries that have taken place during 1905. The publication consists of three sheets of maps, with explanatory and statistical text on the backs, one devoted to Europe, another to Africa, and a third to America. The first is entirely taken up with a most instructive little series of ethno-

graphical maps of European Russia, showing the relative density of the population and distribution of the various races. These maps, with the accompanying letterpress, which contains most useful tables, are based upon the census of February 9, 1897, of which the final results were only published in 1905.

The African sheet contains as its principal map the result of the survey work accomplished during the year in Southern Nigeria, the Kamerun, and French Congo regions. Special notice is taken of the excellent survey by the late Captain Claud Alexander and Mr. Talbot, of the Alexander-Gosling expedition, the map of which was published in the *Geographical Journal* for February, 1905. The other maps on this sheet are small reductions of the French survey in the Sahara, Morocco, Mr. Weld Blundell's survey of the upper Abai, and the Jubuti Addis Ababa railway. Inserted in the text is a block map of the Anglo-Portuguese boundary in Barotseland. The South American sheet contains maps of Messrs. Steinmann, Hoek, Bistram, and Vaudry's explorations in Bolivia; the modification of the boundary between Bolivia and Brazil in the Paraguay region; the recently determined boundary between British Guiana and Brazil; and a small general map of South America, showing the boundaries that have been definitely fixed by treaty. On the three sheets only of which this publication is comprised it is, of course, impossible to do more than make a selection of some of the more important geographical work of the year, and it seems a matter for regret that this useful little annual should not be somewhat extended.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas verkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 27, 28, 29, und 30. Gotha: Justus Perthes, 1906. *Price 6 pf. each part.*

These parts contain the following sheets: 12, Deutsches Reich, Bl. 4; 25, Italien, Bl. 4; 31, Spanien und Portugal; 47, Russland, Bl. 4; 69, Afrika, Bl. 1; 88, Vereinigte Staaten, Bl. 3.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during October, 1906. *Presented by the Hydrographer, Admiralty.*

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2467 m	= 1·8	Plans of anchorages on the north coast of New Guinea. New plan:—Matterer bay. 2*s.*

Charts Cancelled.

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1406 North sea. Dover and Calais to Orfordness and Scheveningen.	New chart. Dover and Calais to Orfordness and Scheveningen	1406
472 Harbours and anchorages on the coast of Haïti or San Domingo:—Plan of Fort Dauphin on this chart.	— — —	—
40 India, west coast:—Karáchi harbour.	New chart. Karáchi harbour (Kurrachee)	40
3037 Korea: — Port Lazaref and Yung hing bay.	New chart. Port Lazaref and Yung hing bay. On Shan Tin (Gensan bay)	3037

Charts that have received Important Corrections.

No. 30, England, south coast:—Plymouth sound and the Hamoaze. 1951, England, west coast:—Liverpool bay. 3021, England, east coast: River Medway between Pinup and Chatham reaches. 3177, South Polar chart, showing tracks of vessels and discoveries. 2840, British Columbia: Haro strait and Middle channel. 1697, Africa, west coast: Garraway point to Growa point. 1003, Africa, east coast: Pungue river. Beira harbour. 8c, Red sea; Sheet III. 81, Red sea:—Mersa Durúr to Trinkitat, showing the approaches to Sawákin. 136, Bay of Bengal, river Húgli:—Saugor point to Calcutta. 1761, China, east coast, Ockseu islands to Tung Yung.
(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat. and Red Sea for December, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for December, 1906. London: Meteorological Office, 1906. *Price 6d. Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for December, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the Hydrographic Office.*

PHOTOGRAPHS.

Asiatic Turkey. **Young.**

Thirty-five photographs of Asiatic Turkey, taken by H. E. Wilkie Young, Esq. *Presented by H. E. Wilkie Young, Esq.*

The Society is specially indebted to Mr. Wilkie Young, H.B.M.'s Consul at Smyrna, for this exceptionally fine set of photographs, the value of which has been considerably enhanced by the careful manner in which they have been titled, described, and dated. In this Mr. Young has set an example that others would do well to follow. The photographs are extremely good specimens of bromide enlargements. As will be judged from the titles, some of them are of exceptional historical interest; among which may be mentioned the ancient (possibly Roman) bridge over the Batman Su, specimens of Hittite sculpture, the inscription on the rock at Baghin, dating from about B.C. 800, and several others.

(1) Inscription at Baghin; (2) The castle of Boshat; (3) Farkin; (7) Gorge on the Kighi Su, tributary of the Euphrates; (8 and 9) Hassan Keif; (10) The raft ferry, Hassan Keif; (11) A Persian tomb, Hassan Keif; (12) The "Hittite" Sculpture, Ivriz; (13 and 14) Soghanli Deresi; (15) Armenian Church, Akhtamar: (16) Island of Akhtamar; (17) Entrance to Medresé Sivas; (18) Urgub; (19) Bridge over the Bohtan river; (20) Diarbekr, the "Mardin Gate;" (21) The town walls, Diarbekr; (22) Ploughing, Diarbekr; (23) Weighing firewood, Diarbekr; (24) Bridge near Diarbekr; (25) The Tigris from Diarbekr; (26) The "Mountain Gate," Diarbekr; (27) Diarbekr from the left bank of the Tigris; (28) Bird Island, Lake Van; (29) A typical village crowd near Lake Van; (30) Mountains between Bitlis and Van; (31) Ferry over the Euphrates; (32) Roman bridge over the Batman Su; (33) Tigris in flood; (34) Sultan Khan; (35) Monastery of Deir el Amr.

Asiatic Turkey and Persia. Cadoux.

Ninety-two photographs of Asiatic Turkey and Persia, taken by H. W. Cadoux, Esq. *Presented by B. T. Cadoux, Esq.*

These quarter-plate photographs were taken by the late Mr. H. W. Cadoux during his recent journey through the Persian gulf district, and have been presented to the Society by his brother, Mr. B. T. Cadoux. Many of them are remarkably clear and would well bear enlargement. The following are the titles:—

(1) Fao; (2-4) Arab children, Tigris; (5 and 6) Bridge at Amara; (7) Boats on Tigris just past Amara; (8) Left bank of Tigris below Baghdad; (9) Watermen, Baghdad; (10) Bridge at Baghdad; (11) Date palms and gatherer, Bakuba; (12) Date palm, Khanakin; (13) Jebel Hamrin; (14) Mahrud and Mahomed; (15) Mansouriyeh and Gizilrobat men; (16) Imam Husein shrine; (17) Hazrat Abbas shrine; (18) Substructure of palace of Nabupulassar; (19) Lion bayards; (20) Maradogg procession; (21) Pir Hazrat Abbas; (22) Imam Hazrat Abbas; (23) Coffee shop, Kerbela; (24) Graveyard, Kerbela; (25) Gateway, Mesjid; (26) Bridge, Musseijib; (27) Drawing water, Euphrates; (28) Safineh, near Kasriyeh; (29) Hai, looking south; (30) Imam Hamza; (31) Creek, Basra; (32) Date-packers; (33) Mirza Mehdr, Ardeshir; (34 and 35) Abdullah ibn Mussallam Sab; (36 and 37) Conglomerate cliff, Samra; (38) Jama Melwayeh; (39) Euphrates river; (40) Euphrates bed; (41) Pilgrims, Iskanderieh; (42) Baghdad; (43) An Al Buisa tent; (44) Tekrit Khadnina; (45) Kharnina Jibooin; (46) A robbed Arab; (47) Jibuin Arab, Shergat; (48) Hills over river near Shergat; (49) Petroleum factory; (50) Luistri cap and gypsum; (51) Cliffs by Tigris; (52) Conglomerate and sandstone, Tekrit; (53) Tigris at junction with Zab; (54) Corner of first chamber, palace of Sennacherib; (55) Side entrance, palace of Sennacherib; (56) Main entrance, palace of Sennacherib; (57-60) Daniel's tomb; (61) Basalt on oolite; (62) Euphrates between Khusr Dinah and Habebi Chelibi; (63) Kellck, Mosul; (64) Bedouin with spear; (65) Wady Tel Afar; (66) Castle, Tel Afar; (67) Turkis, Tel Afar; (68) Band-Shuster; (69) Shuster mills, looking north; (70) Shuster; (71) Group of Shusteris; (72 and 75) Ab-i-Diz; (73) Ahwaz; (74) Castle and river, Shateit; (76) Dizheyl canal; (77) Yezidi village; (78) Tepe Khumsi Yezidis; (79) View of Fart; (80) Zobeyda's tomb; (81) Arab women, Umsnayin; (82) Sheykh Jaffer, Band-i-Kil (83) Band-i-Gil; (84) Dweridge river.

British and German East Africa. Bright.

Ninety-eight photographs of British and German East Africa, taken by Major R. G. T. Bright, C.M.G. *Presented by Major R. G. T. Bright, C.M.G.*

Major R. G. T. Bright, whose name is well known in connection with East African exploration, was attached to the recent British Commission under Captain Smith, R.E., for the delimitation of the boundary-line between British and German East Africa, from Kilimanjaro to Victoria Nyanza, and it was during this expedition that the following photographs were taken. Many of them are extremely good, the views of Kilimanjaro being of exceptional merit. They are all 5 by 4 inches in size; two being joined as one form an excellent panorama of Kilimanjaro.

(1) View across Mombasa harbour to Ras Kidomoni; (2-5) Lake Chala, near Taveta; (6) Government station at Taveta; (7) River Lumi at Taveta; (8 and 9) Isuria escarpment; (10) View from Isuria escarpment looking eastwards across valley of river Mara; (11) River Mara near Isuria escarpment; (12) Kavirondo woman at Kisumu; (13 and 14) Native market at Kisumu; (15 and 16) Kavirondo women in market at Kisumu; (17) Port Florence from opposite side of bay; (18 and 19) Kavirondo women at Port Florence; (20) Kavirondo men at Port Florence; (21) Kavirondo native at Port Florence; (22) Laitokitok; (23 and 24) Country near Laitokitok; (25) British Commission's camp at Laitokitok; (26) Laitokitok Masai, Kilimanjaro in the background; (27) Caravan crossing lava beds near river Lenduraish; (28) Mount Longido from top of Ol Duenyu Erok; (29) Souti Sambu, near river Lenduraish; (30) Mount Shombole; (31) N'Dorobo native on the Mara plains; (32) Country at Gouragu; (33) Native of Kavirondo; (34) Karungu station; (35) Women of Gouragu; (36) Camp Ngorogaish; (37) Country west of Lake Amboseli; (38) Shore of Victoria Nyanza; (39) Swahile drummers of caravan; (40) Building a boundary cairn on Namanga hill; (41) Caravan crossing river Lenduraish near Soüti Sambu; (42) Lava beds near river Lenduraish; (43) Country in Matambatu, Lemoboiti hill in the distance; (44) Native storehouse in tree, Bukira; (45) Women carrying food in Bukira; (46) Boma at foot of Ol Duenyu Erok; (47) Forest on Ol Duenyu Erok; (48) Tree covered with lichen on summit of Ol Duenyu Erok; (49) Mohuru peninsula; (50) Entrance to village, Mohuru peninsula; (51) Ugaya natives at Mohuru peninsula; (52) Drying matama, Mohuru peninsula; (53) Forest on east side of Kilimanjaro; (54) Clearing forest on east side of Kilimanjaro; (55) Camp on Lake Natron; (56) Pagazi river flowing into

Lake Natron; (57) View from the east across Lake Jipe, Ugweno mountains in the background; (58) Native slinger, Buvuma island, Victoria Nyanza; (59) Building a beacon on Buvuma island; (60 and 61) Sesse islands, Victoria Nyanza; (62 and 63) Hut on Sesse islands; (64) Mission station at Bumangi, Sesse islands; (65) Native ferry across Kagera river in Bukanga; (66) Orchinga valley between Ngarama and Ruampara; (67 and 68) Wooding station on Bugaia island, Victoria Nyanza; (69) Crossing swamp in Uganda; (70) Ba-Siba at Mazinda; (71) Valley of Kagera river and Mazinda bay; (72) Valley of Kagera river near Mazinda; (73) A rock in Victoria Nyanza with tree growing on it; (74) The Victoria Nyanza; (75) Uganda canoes on the Victoria Nyanza; (76) The crew of a Uganda canoe on Victoria Nyanza; (77) Papyrus rafts, east of Victoria Nyanza; (78) Kilimanjaro from the east; (79) Kilimanjaro from the north-east; (80) North-eastern slopes of Kilimanjaro; (81) Kibo from Moshi; (82) Northern portion of Lake Natron; (83) Shore of Lake Natron; (84) North-east shore of Lake Natron; (85) Bed of Lake Natron, Mount Shombole in the background; (86) View across great Rift Valley and Lake Natron, from the west; (87) Country north-east of Lake Natron; (88) View across Lake Natron from the east; (89) Country near Lake Chala, Kilimanjaro in background; (90) On the cart road from Moshi to Voi, bridge across river Himo; (91) Market at Moshi fort; (92) Ugweno mountains, looking across Lake Jipe; (93) Ugweno mountains, from the east; (94) Ugweno mountains, looking from across Lake Jipe; (95) Kimawenzi, from the east; (96) Lake Lhasso, formerly large lake, now nearly dry; (97) Country east of Lake Amboseli; (98) Ol Duenyu Sambu, from the west.

Burma. **Sowman.**

Thirty-one photographs of Upper Burma, taken by G. Sowman, Esq. *Presented by G. Sowman, Esq.*

A set of quarter-plate photographs, taken principally in the neighbourhood of Mandalay and the Upper Chindwin district of Burma. The views of pagodas are decidedly good.

(1 and 2) The Queen's or Golden Monastery, Mandalay; (3 and 4) Doorway of Golden Monastery; (5) Tomb of Mindohn Min, Mandalay; (6) Pagoda in Fort Mandalay; (7) The 450 Pagoda, from Mandalay hill; (8) On the platform of the Ayin-daw-ya pagoda, Mandalay; (9, 10 and 11) Views on the Chindwin river below Monywa; (12) Monywa from the river; (13) Corner of Lashio bazaar; (14 and 15) Bazaar at Maung-yang; (16) Pohn-gyi Kyaung Monastery at Naung-pat; (17) At the end of the village, Naung-pat; (18–21) Views of the Chaung-gyi river; (22) The Uyu river at Kuma; (23–27) Views on the Uyu river between Haung-pa and Shwedwin; (28) Village of Ionpara; (29–31) On the platform of the Shwe Dagon pagoda.

Madras Presidency. **Varley.**

Ten photographs of Vijayanagar or Hampi on the river Tungabudhra, Madras Presidency, taken by F. J. Varley, Esq. *Presented by F. J. Varley, Esq.*

These small photographs represent some of the finest stone-carving work in India. No. 8 is a view of the remains of an almost unique stone bridge, whilst No. 10 is of exceptional interest, inasmuch as it shows the method of splitting stone by drilling a series of holes, burning straw in them, and splitting by pouring on cold water.

(1) Temple of Vithoba; (2) Stone rath, or sacred car, temple of Vithoba; (3) Carving in temple of Vithoba; (4) Interior of temple of Vithoba; (5) Porch of a temple falling into ruins; (6 and 7) Stone staircase in a temple; (8) General view showing remains of old stone bridge over the Tungabudhra; (9) View on the Tungabudhra river; (10) Showing method of splitting stone by fire.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Vierte Reihe. Heft 3 u. 4, Vegetationsbilder aus Feuerland, von den Falkland-Inseln und von Südgeorgien. Von Carl Skottsberg. Heft 5, Westafrikanische Nutzpflanzen. Von Dr. Walter Busse. Jena: Gustav Fischer, 1906. *Price 2·50m. each part.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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THE SNOWS OF THE NILE.*

Being an Account of the Exploration of the Peaks, Passes, and Glaciers of Ruwenzori.

By H.R.H. the DUKE OF THE ABRUZZI.

[H.R.H. the Duke of the Abruzzi gave the account which follows of his remarkably successful expedition to Mount Ruwenzori, illustrated by about one hundred magnificent lantern slides, at a special meeting of the Society in the Queen's Hall, Langham Place, on January 12, 1907. The Hall was filled to its utmost extent by a brilliant and distinguished audience, and the meeting was honoured by the presence of His Majesty the King, the Patron of the Society, and by H.R.H. the Prince of Wales, Vice-Patron. During the forty years that as Prince of Wales the King was Vice-Patron of the Society, he frequently attended its meetings, but this is the first occasion on which a reigning British monarch has thus honoured the Society. His Majesty's remarks on H.R.H. the Duke of the Abruzzi and on the lecture will be found at the end of the paper.]

* Map, p. 248. After the Duke's address, it became clear that our Society should take the initiative in attaching his name to some part of the range. He had called five of the six massifs after celebrated explorers who had first seen or visited Ruwenzori. He had named the sixth Mount Thomson, for which we have substituted Mount Luigi di Savoia. Joseph Thomson never saw Ruwenzori, and his famous name should be given to some region connected with his exploits. I have felt the less hesitation in initiating this change, as I have so often acknowledged my great debt to Thomson for his Sokoto journey in 1885, which laid the basis of British rights in a considerable part of Nigeria. —President R.G.S.

I am here, on the kind invitation of the Royal Geographical Society, to describe my recent exploration of the snowy summits, known as Ruwenzori, situated in the heart of Equatorial Africa and between two of the great lakes of the Nile sources, the Albert and Albert Edward. This range was probably seen, for the first time by Europeans, by Sir S. Baker in 1864, and later by Gessi in 1876. The English explorer gave the name of Blue Mountains to the distant heights he saw south of Lake Albert; and Gessi, in some of his private letters, described a strange apparition in the sky resembling snow-covered summits. But neither traveller formed any exact idea of the importance of the range, and to Sir Henry Stanley, therefore, was reserved the distinction of being its true discoverer. Stanley not only saw the mountain to the south from Lake Albert in 1888, but in the following year traversed its western slopes, and one of his companions, Lieut. Stairs, climbed to a height of 10,677 feet on its north-western spurs.

Stanley received many different answers to his inquiries as to the name locally given to these white mountains. Among the various native designations, he chose that of Ruwenzori, which, in the language of Mtsora, means "Rainmaker." A more appropriate one could hardly be found, since, on account of the clouds which continually envelop its flanks, the summits remain invisible for months and months, and even during the brief interval which separates the wet and dry seasons are only seen in the early morning hours. In the dry season they are obscured by haze from the observer on the plains.

Stanley identified the range with Ptolemy's Mountains of the Moon. But on this matter there exists among geographers much diversity of opinion. Some have sought the Mountains of the Moon in Kenya and Kilimanjaro, others in the summits that crown the highlands of Abyssinia; others, again, in the Mfumbiro volcanoes, situated in a district said to be known to the natives as the Country of the Moon, south of Lake Albert Edward and near the sources of the Kagera, an affluent of Lake Victoria and the most remote source of the Eastern Nile.

The Italian geographer, Dr. Hugues, has, at my request, kindly occupied himself with this interesting question. Basing his opinion on the latitudes and longitudes assigned by the Alexandrian geographer to his Nile lakes, which he holds to prove conclusively that these are identical with Lakes Victoria, Albert, and Albert Edward, he inclines to accept Stanley's view. At any rate, Ruwenzori is the only snowy range in the Nile basin, and therefore the only mountain that meets Ptolemy's statement that the Nile is fed from mountain snows.

Stanley's successors in the Ruwenzori region were Dr. Stuhlmann in 1891 and Scott Elliot in 1895. Stuhlmann ascended the valley of Butagu, on the west of the chain, to a height of 13,326 feet, and obtained a remarkable photograph of its glacier-clad peaks. Scott Elliot

made five excursions towards the central ridge, approaching it on the east by the valleys of Yeria, Wimi, Mobuku, and Nyamwamba, and on the west by the Butagu valley. In the last he reached 13,000 feet; in his earlier excursions he twice reached, from the Yeria and Wimi valleys, the watershed, but at lower elevations. Though neither traveller gained the snows, each made considerable collections and scientific observations. Dr. Stuhlmann was the first to recognize four distinct groups, to which he gave, in the order in which they presented themselves to him from north to south, the names of Kræpelin, Moebius or Kanyangungwe, Semper or Ngemwimbi, and Weismann, declaring that the second, Kanyangungwe, was the loftiest.

In 1900, Moore was the first to touch the snows on the Semper or Ngemwimbi, and to gain the height of 14,900 feet on the ridge to the east of this summit, which he erroneously believed to be part of the watershed. In the same year, Sir H. Johnston reached a similar height on the east slopes of the same mountain, which he renamed Kiyanja. To another peak, visible from the lower valley of the Mobuku, Johnston gave the name Duwoni, without, however, being able to ascertain whether it was one of those seen by Stuhlmann.

Since 1900 several attempts have been made on both sides of the mountain. On the east the Mobuku valley was always selected, and no one succeeded in attaining a greater height than Moore. On the west side, Dr. David believed himself to have reached a height of 16,728 feet on the glaciers of Mount Moebius. But as he also admits that he appeared to himself to be some 1400 feet below the highest peaks, his altitude is obviously erroneous. The partial ascents mentioned so far were made by explorers who were not mountaineers. In the winter of 1905 and the early spring of this year, however, two attempts were made by alpine climbers. The former of these parties, consisting of Mr. Douglas Freshfield, Mr. Mumm, and the Zermatt guide, Moritz Inderbinnen, reached in November a height of 14,500 feet on the glacier at the head of the Mobuku valley. Their plans were frustrated by the persistent fogs and rainstorms of the rainy season. They had been misled as to its date by the reports of Sir H. Johnston and others, who had failed to recognize the complete want of correspondence between the rains of Lake Victoria and those on Ruwenzori.

The second party, composed of an Austrian climber, Herr Grauer, and the missionaries Messrs. Maddox and Tegart, reached the lowest point in the ridge already attained by Moore, at a height they estimated at 15,000 feet. Grauer, like Moore, thought he had reached the watershed. This was all that had been recorded up to February, 1906, when I set about to complete my preparations, and settled my departure from Italy.

I knew that a party, sent out by the authorities of the British Museum for the purpose of making natural history collections, had been

on the slopes of Ruwenzori since December, and that one of its members was Dr. Wollaston, a member of the Alpine Club. But no news of any ascents having reached me up to the end of February, I held myself justified in feeling almost perfect confidence that, owing to the rains, which last through March, April, and May, Dr. Wollaston would not be able to make any attempts previous to my arrival, and I had grounds for hoping that I might at least be in time to be able to join him in ascents of the highest peaks.

By comparing the information furnished in the published narratives of my predecessor, or by word of mouth from the latest writers, such as Freshfield and David, I was led to the conclusion that the chain of Ruwenzori consists of four considerable mountain blocks running from north-east to south-west. Whether they were separated by deep valleys or connected by snowy ridges remained uncertain. One of these mountains, Semper or Ngemwimbi according to Stuhlmann and Moore, Kiyanja according to Johnston, Freshfield, and Grauer, was easily accessible from the Mobuku valley. The highest peak, perhaps identical with the Moebius of Stuhlmann, might be accessible from the ridge reached by Grauer.

The one point on which all explorers agreed, although they had attempted the mountain at different seasons, was the abominable weather encountered in the higher region: rain almost perpetual; mists in the brief intervals between the downpours; rare clearances, and those only about dawn. From notices furnished by missionaries in Toro and reported by Freshfield, and from the accounts of Sir William Garstin, I learnt that the least unfavourable months for mountaineering attempts were June and July, and also January and February, when, although the atmosphere, particularly in the lowlands, is obscured by haze, the rainfall is far less persistent, though it does not completely cease.

My expedition, therefore, had to take place in June and July. Considering our uncertainty as to the features of the mountain, and even its height, which had been variously estimated between 20,000 and 17,000 feet, and also the bad weather and clouds which must inevitably impede our progress above the snow-level, it seemed expedient to provide ourselves, as we had already done on my Mount St. Elias expedition, with the material necessary for camping and living on the ice. It followed that we must also take with us from Europe porters for the transport of this material at high elevations, since the natives of the eastern slope, the Bakonjo, though excellent carriers below the snow-level, become useless as soon as ice is touched. In provisioning my party I counted on a stay of forty days in the upper region, believing that this ought to be enough to conquer all obstacles, even with the thickest mists and most adverse atmospherical conditions.

On April 16 I left Naples for Mombasa. The following were the names of my companions: Captain Cagni, of the Italian navy, charged

with observations general, and specially magnetic; Lieut. Winspeare, also of the navy, charged with observations general, meteorological, and topographical; Dr. Major Cavalli Molinelli, physician, and charged with zoological and botanical collections; Signor Sella, photographer; Dr. Roccati, geologist, and charged with zoological and botanical collections; two Alpine guides, Giuseppe Petigax and Cesare Ollier, and two porters, Giuseppe Brocherel and Lorenzo Petigax, all four of Cormayeur; an assistant photographer, Erminio Botta, of Biella; and a cook, Gini Igino, of Acqua Pendente.

The complete camp-material (tents, beds, sleeping-sacks, seats, tables, baths, stoves, hermetically closed cases for clothes, photographic material, provision for botanical, mineralogical, and zoological collections, sporting guns and ammunition) was divided into 114 cases, each weighing 50 lbs. English. These were numbered and arranged so as to be easily carried by the porters on their heads. The provisions were divided into 80 cases, each also of 50 lbs., and each containing provisions for one day for twelve persons. The cases were of tin, soldered and protected against hard knocks by a thin wooden casing. Forty of these cases were intended to supply the party between Entebbe and Fort Portal, and in these there were no preserved meats, since fresh meat can always be obtained on the march. The remaining 140 cases, destined for the mountains, contained meat preserves. The total weight of goods to be transported from Entebbe to the slopes of Ruwenzori demanded 194 porters.

On the morning of May 3, after a voyage of seventeen days, broken only by short stays at Port Said, Aden, and Jibuti, the white houses of Mombasa were in sight, and soon afterwards we anchored in the port of Kilindini. Here the English, French, Austrian, and German boats call. Until a pier connected with the Uganda railway is finished, merchandise is transported to the custom house at Mombasa by means of the narrow channel which unites on the west the harbours of Mombasa and Kilindini.

May 3 was spent from morning to night in the laborious task of disembarking our baggage and loading it on the train, and we owed it to the kind assistance of the English officials, and the privileges which were allowed to us, as well as to the help of our fellow-countrymen, that we were able to start on the next day. I was anxious to make our stay at Mombasa as brief as possible. This port marks the entrance to the malarious zone, which from the time of my leaving Italy I had determined to cross as rapidly as possible, in order to avoid the risk of fever among the persons attached to my expedition.

Unfortunately, and with the greatest regret, at the very outset of our expedition we were forced to leave behind at Mombasa one of our companions, Winspeare, who, having fallen sick of typhoid fever during the last days of the voyage, was not in a condition to continue the journey.

With the approval of Dr. Cavalli, he was left in the hospital at Mombasa, so that he might return to Italy as soon as his health should allow him.

On the morning of May 4 we started with the weekly train for Port Florence. The line, 640 miles in length, was begun in 1896 and finished in 1902. It rises from the sea to a height of 7330 feet, to descend to 3675 feet on Lake Victoria. The average pace of the trains is 20 miles an hour, and allows the traveller to admire a perpetually changing panorama. From the tropical landscape, the woods of bananas and palms in the vicinity of Mombasa, the line rises gradually to the wide Athi plains, a great game preserve full of zebras, gazelles, antelopes, rhinoceroses, and lions. Beyond Nairobi (the new capital of the East African Protectorate) the train mounts again on the slopes of the heights which form the eastern boundary of the great Rift valley, the colossal chasm which extends from Lake Nyasa on the south to Lakes Rudolf and Margherita on the north. Wandering amidst the most luxuriant vegetation, now circling round the crests of steep spurs, now penetrating the recesses of narrow solitary glens, the line reaches Limuri. At this station the long descent into the Rift begins, and, after making a semicircular loop and traversing several lofty viaducts over deep wooded ravines, the train passes the base of the extinct volcano of Longonot and the shores of Lake Naivasha, before again climbing to Njoro, the highest point on the line on the western barrier of the Rift.

Along the line and at the stations are seen half-naked natives with no clothing but skins, and their hair and faces dyed a ruddy tint. The men are of proud aspect, many armed with spears and shields; the women, some of whom carry their infants on their backs, have their arms and legs decorated with brass spiral ornaments which impede their movements, and are disfigured by enormous earrings of the shape of tambourines, which are fixed on the lower lobe of the ear. Beyond Njoro the rail descends the Mau escarpment across vast expanses of country covered with elephant grass, to Kisumu or Port Florence, the head of the line on Lake Victoria, whence the steamer for Entebbe starts. We reached Kisumu at 11.30 on May 6, having made in forty-eight hours a journey which a few years ago took nearly three months to accomplish. Once more man has proved here what he can do when his daring undertakings are supported by a clear understanding of the aim to be attained, and by an unrelenting will. While our goods were being embarked, I visited the famous market of Kisumu, where thousands of men and women clad in their best clothes, those provided by Nature, come to traffic. It is remarkable that in this part of Africa, we meet alternately with races who go completely naked, and others who are fully clad, without, as it would seem, morality being in any way the gainer by the greater appearance of modesty. The money current throughout Uganda

is the Indian rupee; cowries are still employed, but only in petty transactions.

On the same day, the 6th, we left Kisumu. The navigation is only by day, and about 6 p.m. we anchored under the island Rusinga. The waves broke with a gentle murmur on the shore; long and narrow canoes, with great beaks on their prows, impelled by twenty or more rowers, alternately approached and quitted the side of the *Winifred*. In the calm water between the reeds, a hippopotamus from time to time raised his huge head, and the birds, seeking their nightly resting-places, flew towards the rocks scattered along the shore. The sun sank to the west in a semicircle of fiery clouds, and shot its last ruddy rays on a land which is only now opening itself to civilization. The clouds, after a rapid transition from brilliant red to more delicate tints, seemed to melt and disappear in the shades of evening, which spread rapidly over the lake. Stories of slavery, of cannibalism, of cruel and despotic kings, of bloody battles, of districts decimated by the terrible malady of "sleeping sickness," which has recently invaded this region, rose in succession before my mind. And then to the memory of a wretched past and of a present not altogether prosperous succeeded, in the calmness of the night, the vision of a better future, when, through the exertions of patient and heroic men of science, the scourge which still ravages these people will be vanquished, and on the shores of the lake now devastated by sickness, towns and villages will multiply, and the high plains will be cultivated and covered by the frequent farms of European colonists.

On the afternoon of May 7 we arrived at Entebbe, or Port Alice, the seat of government of the Uganda Protectorate. The town, divided into a European and a native quarter, occupies a fine position on a narrow and lofty promontory between two deep bays of the lake. The European houses are of the type common in tropical countries, with ample verandahs, and surrounded by gardens. Everywhere, on the beds, the windows, and round the balconies, are mosquito curtains, which serve as a protection against the dreaded sleeping-sickness fly. The native dwellings are circular huts.

My reception at Entebbe was almost of an official character. The commissioner, Mr. Hesketh Bell, was kind enough to welcome me and Cagni as his guests, and the other members of my party were hospitably lodged by Messrs. Ennis Wyndham, Carter and Martin. Receiving in their comfortable homes every possible courtesy, we spent at Entebbe a week of great enjoyment. But it was not a time of idleness, for we had to carry through the final preparations for our enterprise, and my work was the harder from having lost the valuable aid of Cagni, who fell ill of typhoid fever almost immediately on our arrival. His fever, not severe at first, increased to such a degree as to necessitate his removal to the hospital, and to make me lose any hope of having his company in my expedition. To await his recovery at Entebbe, which might be delayed

who knows how long, would have been to lose the precious fine weather of June and July, the best months for the mountain, with the risk that while we were waiting another of us might succumb. The decision made before leaving Italy to traverse with all possible speed the malarious zone could not be altered even though it lost me the aid of Cagni, the affectionate, intelligent, and trusted companion of two of my previous journeys.

The dawn of May 14, the day fixed for our departure from Entebbe, was hailed by all with enthusiasm. We left with pleasure the cares of civilized life for the, in many ways, more attractive camp existence. After having bidden farewell to those who had assisted us, and to Cagni, who was in high fever, we met at 8 a.m. in front of the Equatorial Hotel, the appointed place of departure. Here were assembled our porters to the number of 220, almost all Baganda. They were engaged at four rupees a month, to carry on their heads weights up to 50 lbs. over some 400 miles. They had been enrolled by Signor Bulli, an employé of the Società Coloniale Italiana, at the request of the Commissioner of Uganda.

The caravan also comprised twenty-seven more porters in the employ of Mr. Martin (who accompanied us, by order of the Commissioner, as far as the frontier of the district of Uganda), an escort of twenty-six Indian soldiers, the "boys" who acted as our personal attendants, the porters of the headman of the caravan, of the soldiers, and of the "boys," and the grooms for our horses and mules—in all more than four hundred persons. The front of the caravan was already out of sight on the Kampala road when we who brought up its rear set ourselves in motion.

The distance from Entebbe to Fort Portal is about 180 miles. The difference in level (about 1160 feet) is overcome by four steps separated by three basins. The first of these receives the streams that flow to the south into the river Katonga, and so to Lake Victoria. In the second and third basins run the affluents of the Misisi, which flows to the north into Lake Albert. The last of the four steps is the watershed between the waters flowing towards Lake Albert and those flowing to Lake Albert Edward.

The whole of this vast upland between the lakes is intersected in every direction by hills, in the eastern portion close and intricate, in the western on a larger scale and less connected. The vegetation is equally distributed in accordance with the nature of the ground throughout the region—on the hills, tall grass and isolated groups of trees: in the hollows, where the water runs, fragments of tropical forest; where it stagnates, marshes covered with papyrus and water-lilies. The track from Entebbe to Fort Portal, in places a road, in others a mere path, sometimes keeps along the ridges of the hills through the tall grass, sometimes descends into the valleys and traverses the forest.

In the first stages, where the country is most undulating, it is a

CARAVAN NEAR BWEYA, ON THE ROAD TO FORT PORTAL.

continual switchback on rapid inclines. Beyond Lake Isolde the slopes are gentler, and level tracts occur, which serve as oases of rest for the unfortunate porters. Swamps and thickets diminish as Fort Portal is approached, and the country wears a more healthy aspect.

The region is inhabited, and all along the road dwellings may be found, but they are so well hidden in the high grass and the banana plantations as to be rarely visible. The ground is only cultivated in the immediate neighbourhood of the huts, since, as in most tropical countries, the indolence of the natives limits cultivation to what is indispensable for their own maintenance. Bananas, colocarias, potatoes, ignami, beans, cotton, maize, panico sesame, and sugar-canes are cultivated in the plains. Fieldwork is everywhere left to the women.

We were fifteen days from Entebbe to Fort Portal. The marches varied from three to six hours. The start was always made at dawn, about 5.30, and we reached camp at latest at 11.30 a.m. We camped far from villages, on ground prepared for the purpose. Our tents were pitched round a cabin, or rest-house, in which, as a rule, we took our meals. Cabin and tents were surrounded by a high fence, which served not only as a defence against wild animals, but also as a barrier between our camp and that of the porters.

This was composed of a number of cabins, which the porters themselves built with the high grasses in a few minutes. Each held two or three men. Before these cabins the Baganda employed themselves till late in the night cooking the sweet potatoes and bananas which constitute their ordinary diet. Although they had often marched five or six hours over very difficult ground, carrying weights of 50 lbs., they seemed always content with their one frugal evening meal, ready for exertion, and resigned to toils and suffering.

The necessity of attending to a number of details prevented us, during the first few days, from enjoying to the full the picturesque and adventurous side of nomad existence.

But little by little, as the caravan began to organize itself, our life became a source of intense enjoyment. Our camp was teeming with humanity, and animated by the games and dances of the natives. Now some chief would arrive with gifts from the neighbouring villages, now a train of women carrying food for the caravan. The hours passed quickly, and the mind found difficulty in registering the innumerable new impressions which awaited it, and which, after all, formed but a frame to the purpose which preoccupied us, to push forward without a halt in our undertaking.

The temperature was pleasant in the morning and evening, cool during the night, and warm in the middle of the day. After supper we met round a large fire lit in the centre of the camp. This served not only for warmth, but as a precaution against the minute enemies that carry malarious fever.

This seems to me the occasion for a brief parenthesis as to the use of quinine as a propylactic. Some of those who have resided in Africa for lengthened periods throw doubts on its merits used as a preventive, and, in proof of their belief, cite their own immunity without use of the drug. I should refer this to their constitutional indisposition to malarial infection. It is conceivable that, for persons obliged to inhabit permanently malarious localities, the continuous use of the remedy may be worse than the disease. But for those who have only to traverse an infected zone, I believe it to be prudent to follow the established custom and take daily moderate doses of quinine.

Although in this district elephants abound and lions are not infrequently met with, as also are zebras and antelopes, we did not pursue them. Small game was abundant—a short stroll round camp sufficed to procure a provision of guinea-fowl.

Proceeding thus, without fatigue or delays, we reached the frontier of the province of Uganda between the camps of Lwa lumutkuza and Kichiomi. Here we parted with regret from the sympathetic and jovial Mr. Martin, and continued our march with Mr. Knowles, the Acting Commissioner of the Western Province. In the measure that we approached nearer to the western lakes, the hope of seeing the chain of Ruwenzori grew stronger. Twice we almost believed we had recognized it, but in each case we were deceived by the white clouds, which piled themselves up in the form of an immense snowy mountain mass. At last, two days before reaching Fort Portal, a short distance from the camp of Kaibo, Ruwenzori appeared suddenly in the west, towering above the mists that hung round its flanks. We distinguished several summits with extensive glaciers, the lower portions of which were concealed by lofty spurs, and among these summits the loftiest was crowned by three peaks, the southernmost of which was separated from the others by a deep depression. This was the summit recognized as the highest by Freshfield, and identified by him wrongly with Johnston's Duwoni, which had been named Moebius by Stuhlmann. Next day, from Butiti we again saw the snow-peaks, but, being nearer, the spurs hid more of them. From Fort Portal no part of the loftiest summit is visible, though the tops of the more northern peaks are just seen over lower ranges.

On May 29 we reached Fort Portal, the westernmost British military station in Uganda.

Mr. Knowles had, with kind forethought, begged Dr. Wollaston, of the British Museum party, to come to Fort Portal and give me news of his attempted ascents of Kiyanja and Duwoni * in the preceding month. Dr. Wollaston informed me of his ascent of a point not the highest on the Kiyanja ridge, and of his ascent of a peak he believed

* The summit east of Grauer's gap I propose to call Wollaston peak. See note on map as to Sir H. Johnston's two Duwonis.

to be Johnston's Duwoni, the summit on the right looking up the ice-fall of the Mobuku glacier. He told me that this peak was lower than Kiyanja, and informed me of the existence of two snow-peaks higher than Kiyanja and north-west of it. He could not tell me how these peaks were connected with Kiyanja, confining himself to an opinion, which proved erroneous, that they were situated west of the watershed. This information contradicted that which I had previously derived from Freshfield, and left me uncertain as to how to reach the highest peaks. Should we follow the Mobuku valley, or the Butagu valley on the Semliki side which had been taken by Stuhlmann? If the highest peak was in fact divided from Kiyanja by a deep valley, and if the passes leading to it from the Mobuku were impracticable, how could we transport our camp across the range? In this case the better course might be to take the Butagu valley. But to reach the latter we must make a circuit round the southern flank of the chain, and traverse part of the Semliki valley, where we were uncertain whether we should find local resources sufficient for our caravan, or a friendly welcome from the inhabitants. Of the two alternatives we chose that which involved the shorter journey —to ascend the Mobuku and determine on the spot whether we must cross to the Semliki side.

Fort Portal is situated 5036 feet above sea-level, in a healthy situation in a wide amphitheatre, enclosed on the west by Ruwenzori, and on the east by the hills that form the watershed between Lakes Albert and Albert Edward. The Europeans resident there, including ladies, number fifteen—the Commissioner, the Collector, the commander of the troops, and the Protestant and Catholic missionaries. The country round it is well cultivated. In the land belonging to the Catholic mission all European vegetables are grown and flourish.

We rested at Fort Portal on May 30 and 31, and this halt was pleasant to all, and specially to the porters, many of whom, from having walked barefoot, had sore feet.

On June 1 the caravan was again in motion. We made a short halt before the royal residence in order to pay our respects to the merry King Kasagama and his friendly and still merrier prime minister, and another at Notre Dame de la Neige to bid farewell to the excellent fathers of the French mission. Then we marched south towards the Mobuku, accompanied by the Collector, Mr. Haldane, Mr. Knowles, and Dr. Wollaston. The last named left us in the evening to join the British Museum party in the valley of the Nyamwamba.

We reached Ibanda in the Mobuku valley in three marches, halting at Duwona and Kasongo. The country, though fertile, is little cultivated. We crossed several streams, two only, the Wimi and the Mobuku, of sufficient importance to delay the passage of a caravan or to hinder it when in flood. Owing to the dryness of the season, we had no difficulty with the Wimi; to traverse the Mobuku we made use

of a rope, below which the natives of the district stationed themselves so as to rescue any men or burdens that might be carried away by the stream. Although the weather was fine, we saw no more of the snow-peaks, which were hidden by the lower ranges. But on leaving Kasongo on a glorious morning, and descending into the Hima valley, we again saw two rock peaks,* and beneath them a large glacier. Marching continually to the south, the rock peaks disappeared, and we could see only the two summits visible from Kaibo and Butiti, and recognized by Freshfield and ourselves as the loftiest. When we had descended into the Mobuku valley, a new peak of mixed rock and snow came into sight, with a large glacier on its north, which we quickly recognized as the Duwoni of Sir H. Johnston's illustration.† We were thus more fortunate than our predecessors in seeing the chain first from a distance and again before entering the Mobuku valley, and we felt confident that the peak we and Freshfield held to be the highest was perfectly distinct from Johnston's Duwoni.

The chief's residence at Ibanda is situated in a part of the valley where it expands into something of a basin. At the head of the valley rises a lofty rugged summit, over which towers the snowy block of Duwoni.

The day, serene when we reached Ibanda, sank into a still clearer night. The waters of the Mobuku murmured at my feet; below our camp burnt a hundred fires, which appeared and disappeared from moment to moment, according to the grouping about them of our porters. The valley's outlines were visible under the starry sky, but my eyes were irresistibly attracted towards the white snows of Duwoni, with a gaze of hope such as that which, on a black and stormy night, the sailor turns to the lighthouse of a hospitable port.

On June 4 we left Ibanda, our porters encouraged by a splendid morning. They started at a good pace up the level valley, until they came to a hill-side so steep as to take away the breath even of unburdened men. Our caravan, so cheerful at the start, became silent. After two and a half hours' march we reached Bihunga, with but a very small portion of our following. Bihunga is 1791 feet above Ibanda, and 6320 feet above sea-level. Its huts are the highest dwellings of the Bakonjo, mountaineers of gentle manners and peaceable habits, who, despite the rigours of their climate, go habitually naked. The British Museum party had spent several months here, and their stay was recorded by a commodious hut, which we used as a storehouse for some of our loads. We had no little difficulty in pitching our tents on the very scanty level ground, which hardly afforded room for them. From the camp we had a fine view over the lower part of the valley, in which, however,

* From Sella's photographs, we afterwards recognized them as the points named on the map Elena and Savoia.

† 'The Uganda Protectorate,' vol. 1, p. 158.

the waters of Lake Ruisamba were not visible; looking upwards, the view was limited by a projecting spur. The next day, again favoured by the weather, we advanced to our next camp. The path, on leaving Bihunga, climbed the spur just mentioned, and then, descending steeply, crossed the Chawa and entered Mahoma, through a splendid forest of podocarpus, tree-ferns, and laurels, shut in between lofty rugged slopes, also covered with the densest vegetation. The path then climbed again on the spur which divides the Mahoma and Mobuku torrents, following its actual crest as far as Nakitawa.

The descent into the Mahoma valley, over very slippery ground, had already delayed the march of the porters, which was still further slackened by the steep climb to Nakitawa. We took four hours to reach this spot, and most of the porters were much longer. The refuge of Nakitawa, 1417 feet above Bihunga and 8602 feet above sea-level, lies under the shelter of a huge erratic block perched on the brow of the ancient moraine, which now divides the valleys of the Mobuku and Mahoma. Many hundred feet under the camp is a steeply inclined hollow, once the bed of a glacier, but now the channel of a torrent, which continually erodes it. Opposite our camp towered majestically the broken walls of the Portal Peaks, between which opened a valley, which seemed to lead to the Duwoni seen from Ibanda. We had believed up to that time that the Mobuku flowed from that mountain, but we were now inclined to think that its meltings joined the Mobuku below our camp.

Previous explorers had recommended the Mobuku as the best way to the upper ranges, and naturally, in the absence of other reasons, we had determined to follow their counsels. But since reaching Ibanda doubts had arisen in my mind as to whether we were taking the best road to the snows we had had in view. It seemed to me that this road was to be sought in the valley that opened opposite Nakitawa, which would lead to the Duwoni of Johnston, while we, by following the Mobuku, should increase our distance from Duwoni and place another ridge between ourselves and that peak.

At Nakitawa we left more than half our Baganda porters. With those who remained and some ninety Bakonjo we resumed our march on the 6th, no more favoured by fine weather, but in fog and rain. As far as Nakitawa there is a path, beyond it comes to an end. We walked at first on the crest of the moraine, opening a track between the stems of the bamboos. We next traversed a swamp, where we sank to the knees. Then crossing to the left bank of the Mobuku, and always wading in mud, we reached, after four hours, the refuge of Kichuchu. We arrived in a wretched state, exhausted by the traverse of so much swampy ground, and drenched by the rain and the moisture that dripped from the trees and grasses.

The refuge of Kichuchu is 1131 feet above Nakitawa, and 9833

feet above sea-level. An enormous cliff of overhanging rock supplies, for the narrow space immediately below it, a very inadequate shelter against the weather. In this space the soil, if protected from the beating rain, is made moist by the water which streams down the face of the cliff. We succeeded in erecting three of our tents under the protection of the cliff. The bad weather, the detestable path, and above all the want of provisions, deprived us of the aid of the last Baganda who had remained. We could not compel them to follow us as we could not assure them their daily food. We abandoned some of our loads, and went on with only Bakonjo porters.

Leaving this camp, one climbs for about 1000 feet by a narrow natural gully cut in a rocky barrier. This staircase brought us to a plain and a wood of tree-heaths, where our march was impeded, not only by the branches and trunks of these plants, but also by a deep-lying layer of the trunks and branches of an older forest buried in moss and fallen to the ground for who knows how many years. The Bakonjo, with 40 lbs. and more on their heads, walked like so many squirrels, bending so as to pass their loads under the trees, or leaping from trunk to trunk with such agility that we had difficulty to follow them.

We recrossed the Mobuku to its right bank, and found ourselves before another step in the valley, about 650 feet high. Above it we were met by an unexpected sight. A long level valley enclosed between steep walls stretched before us, ending in another ascent, beyond which lay the highest refuge, Bujongolo. The bottom and sides of the valley, as far as the eyes could reach, were entirely covered with a fantastic vegetation. Bushes of Helichrysum with white everlasting flowers carpeted the ground, over them rose the tall funereal stems of lobelias and the monstrous growths of gigantic *Senecios*. Despite all this exuberance of vegetation, there was an absence of any feeling of life; the only familiar sound was the light murmur of the cascade close to the refuge of Buamba. We arrived at the refuge of Bujongolo in about four hours; but many of the porters, who were less affected than ourselves by the love of mountains, remained behind at Buamba. We were therefore compelled to pass the first night without tents, and some of us without a bed. After fifty-four days' travel and a journey of 6000 miles, we had at last arrived at the foot of the range we proposed to explore.

The refuge of Bujongolo is formed, like that of Kichuchu, by a rocky wall that overhangs, and is even less convenient than the former, on account of the many blocks that have fallen from the wall and made the ground so uneven that it is only possible to plant a single small tent. We decided, therefore, to construct platforms by cutting down some trees, and thus obtain sufficient space to set up our six tents, which were arranged at different levels in two groups, separated by an enormous block. To pass from one group to the other, we were

forced to take a shower bath, for from the brow of the rocky wall that made a roof to our camp there fell, even in fine weather, a continuous dripping, or else to find a passage by acrobatic exertions between the block and the rock-wall. The Mobuku flowed at our feet in a deep ravine, which open to the west only, allowed our eyes to wander to the snowy southern slopes of Kiyanja.

On June 9 our little camp was all movement, for Knowles and Haldane were returning to Fort Portal, taking with them my sincere thanks for the valuable help which they had given me in pushing forward the expedition, and the Bakonjo porters went down to fetch the loads left at Nakitawa and Kichuchu. I, with my Alpine guides and five Bakonjo, set out to reach the watershed. We followed the Mobuku in the tracks of the earlier explorers to the last camp made by Grauer near the glacier. Here the guides took the lead, and, still following for a time the route taken by Grauer, and then keeping to the rocks on the right (ascending) of the glacier, we easily reached the icefall. We induced the natives to follow us for a short time, but, being without shoes, they slipped more than we did on the mossy slabs, and cut their feet on the sharp stones. At 13,780 feet, a greater height than they had ever reached before, we were compelled to leave them. Clouds had now come up, and we were forced to camp.

Next day, favoured by fine weather, we reached the crest in three-quarters of an hour, over slightly crevassed snow-slopes. This three-quarters of an hour seemed to me a century, and I pressed the guides to a pace which brought us all breathless to the top at dawn. We were on the lowest gap in the ridge which connects Kiyanja with the peak to its east climbed by Wollaston. The cloudless sky allowed us to see all the snowy peaks which constitute the loftiest part of the chain. On the north the ridge we were on fell in a precipice. Opposite us in the same direction appeared four distinct mountains, with snowy peaks far loftier than our standpoint. The two central mountains were almost in line. The western, and nearest to us, was crowned by four peaks, disposed in pairs in two groups; the northern pair were separated by a marked saddle, and were the loftiest in view. They were the points seen by Wollaston, and identical with those seen by us from the Hima valley, and previously from Butiti, which had presented themselves as the highest of the range, and any doubts that might have existed as to their importance were removed now that we found that they were the most western and distant of all.

The two glens that separated the two outside from the two central groups of summits met at our feet in a valley, which ran parallel to the ridge on which we were standing. We were unable to ascertain as yet the lower course of this valley, but we saw enough to enable us to feel sure that it drained towards the east. In our subsequent expeditions we identified it as the valley of the Bujuku.

The peak to the east of the Mobuku glacier, climbed by Wollaston, which had proved to be lower than Kiyanja, could not, we saw, be the Duwoni visible from Ibanda, but was a secondary summit not on the watershed.

It was only 6.30 a.m., and we had all the day before us. The weather was fine, and we decided to climb Kiyanja in order to reconnoitre the route we should have to take in order to reach the well-marked saddle between the two highest peaks. We descended on to the glacier south of the crest, and then returned to it and followed it to the summit. Meantime clouds had gathered. In the short breaks in the vapours we saw a great depression between Kiyanja and a snowy mountain situated to the south (Freshfield's "Southern Peak"), which formed a col, leading on one side to Bujongolo, on the other to the Semliki. There seemed no difficulty in crossing this pass, and so reaching the valley between Kiyanja and the highest peaks. It was warm (43° Fahr.), and we rested for four hours on the rocks, waiting for a clearance, which never came. At 1 p.m. we left the top. Returning in our footsteps, we gained the camp from which we had started in the morning at 3.30 p.m. Here we found Sella, who had climbed thus far in order to take a photographic panorama.

Next morning we returned to Bujongolo. Rain kept us prisoners there on the following three days, June 12, 13, 14. It was useless to attempt to move in thick fog and pouring rain. Had we started, our Bakonjo porters would not have followed us. We remained during these three interminable days confined in the narrow dungeon, which hardly held our tents, and buried in dark, dank fog. Even at night there was no peace. On some of our tents the water from the rocky brow overhanging them dripped continually with a monotonous and irritating noise. The only incident was a call from a dangerous and uninvited visitor, a leopard, whose tracks we had already noticed. On one night he devoured two sheep; on another, while I was sitting before my tent, he approached me within a few feet. The animal fled as soon as I rose, but I was left uneasy at his presence almost inside our camp. For the porters, who slept without shelter, and for the men sent out to fetch water, the vicinity of the beast was a real danger.

On the night of the 14–15th an east wind rose and partially dissipated the clouds. In the morning, under a clear sky, we left Bujongolo with our Alpine porters and guides and nine Bakonjo, having thus assembled all our available forces. At the angle where the Mobuku valley bends north, we turned to the left and made a circuit under the southern slopes of Kiyanja. The ground was, in consequence of the rain of the three preceding days, very bad going. After an hour's walk we were wet through, covered with mud, and furious at having to walk over swamps and slopes in which we alternately sank up to our knees or slipped back twice as far as we had intended to step forward. To

render our march still more disagreeable, the mists came down on us. The descent on the Semliki side was worst of all. The guides in front had to hack out a path with their axes through the thick bushes of *Helichrysum* and *Senecio*. Rock-buttresses forced us to long circuits to turn them, and our native porters, weary and little willing to follow us into Congo territory, halted and required aid at every moment.

About 4 p.m. we reached two lakes, the waters of which, hardly rippled by the breeze and the movements of wild ducks, reflected on their surface the white peaks of the surrounding ranges.

The evening was splendid, and put an end to our bad humour. The sun descended over a broad valley, which opened to the west, into a bank of clouds, to break out again below them before it sank finally beyond the great forest of the Congo. Not only the horizon, but the whole atmosphere was suffused with a rosy tint, which made the valley and the vast forest appear as if wrapt in flame.

To induce our porters to start on the next morning was no easy matter. Full of distrust, and ignorant as to where we were taking them, they sought every possible excuse for delay. Being without an interpreter, we could neither understand their remonstrances nor explain our own plans. My patience and that of the guides was on this march sorely tried.

Next day we lost much time in forcing a way through the thick bush on the side of the lakes. Then we followed the valley, keeping under the cliffs of Kiyanja. In two days we transported our camp to the glacier which descends from the group we wished to climb into the valley we were traversing. A steep pass divides this valley from that we had seen under Grauer's gap.

The northern face of Kiyanja fell almost perpendicularly on the valley we had traversed. The mountain which we had already seen to the north from Grauer's gap bore on its western flank a large glacier. Between this mountain and that on whose slopes we were was the deep valley and lake visible from the gap. The waters of this lake drained into a valley, which runs at first parallel to the ridge which unites this gap to Kiyanja, and then bends to the south under several peaks east of that climbed by Wollaston.

The mountain with a large glacier to the north-east of the camp was the Duwoni seén from Ibanda, and the valley to the east of the camp was the head of the valley which opens opposite Nakitawa. It was now beyond doubt that Grauer's gap was not on the watershed. All the torrents which unite in the valley to the west of Grauer's gap are tributaries of the Mobuku.

We sought rest in a state of nervous anxiety. It was not the roughness of the rocks which kept off sleep, so much as our fears lest the weather, which had grown less settled during the day, might force us to remain camped who knows how long, here at the very foot of the desired peaks.

At dawn the heavens gave no fair promise, but we started, nevertheless, Petigax leading, Ollier next, I third, and Brocherel bringing up the rear. In an hour, over easy slopes, we gained a level glacier broken by but few crevasses. The twin peaks, separated by their characteristic saddle, faced us close at hand. It was 6.30 a.m. The sun shone for a moment, and then hid himself in the clouds that rose from the east. Soon we began to feel puffs of wind from the south-east, which rapidly increased in force, and halfway across the plateau the mist enveloped us. Petigax marched on, and led us to the ridge which fell from the southern and lower of the two highest peaks. The snow was in good condition, and after cutting a few steps we gained the top at 7.30 a.m.

In the dense mist we could not even see the higher peak, which was only a few hundred yards off. On the previous day our guides had noticed that there might be difficulty in climbing from the saddle to the higher peak on account of its overhanging cornice, and in the fog we could neither reconnoitre the descent from our own peak to the saddle, nor the best means of dealing with the cornice. We must either put off to another day the ascent, or descend the ridge we had climbed, pass under the saddle, and attack the higher peak where there was no cornice, or attempt a direct passage by way of the saddle. The guides said nothing. It would have been useless for me to suggest to them to go back, and we resolved to take the saddle route, reserving to ourselves the alternative and more circuitous route should the former prove impracticable. The excellent condition of the snow made the descent to the saddle shorter than we had anticipated. We climbed up by a very steep snow-slope to the cornice. We had to evade the icicles and ice-columns that hung from and supported it in order to find a means of gaining the ridge. The slope was so steep that my head almost touched the feet of the guide in front of me. In cutting steps Petigax sent down a shower of ice on his followers, and I looked forward with pleasure to the moment when our party would resume its normal relations—one in front, and not one above the other. We found at last a sort of ice chimney 6 feet high. Petigax, to climb up it, had to plant his nailed boots on the head and shoulders of the unfortunate Ollier, who served him as a mounting block. The ridge was ours, and at the same time the top.

It was 11.30. A fresh breeze blew from the south-east; the clouds swept past but few yards under us, leaving clear only the two peaks, that we had left and that on which we were standing. And to these summits, the only ones in view at this moment which crowned my efforts, I gave the names of Margherita and Alexandra, in order that, under the auspices of the two royal ladies, the memory of two nations may be handed down to posterity: of Italy, the name of which resounded for the first time on these snows in our shout of victory; and of England, which in its marvellous colonial expansion carries civilization even to the slopes of these remote mountains.

THE HIGHEST PEAKS OF RUWENZORI.

Having unfolded the little flag which had been given me at Rome by Her Majesty Queen Margherita before my departure, I fastened it to a staff planted on the highest point of the snowy dome, to the triple cry of "Viva Margherita!" "Viva Alexandra!" and "Viva l'Italia!" The winds blew out the tricolour above the snows, which up to that time had known nothing but the breath of the tempest, and the little letters of the motto which the august lady had had embroidered on the flag, "Dare and hope," were displayed to our view. The minute letters, beaten by the winds, may disappear, but the words will remain attached to the name of this summit, as if they were engraved on its rock in indelible characters, and will serve, as they did to us, as an encouragement and support to all the hardy explorers who, among the still unknown and savage wilds of Africa, labour among hardships and perils for the advance of civilization.

The moment has now come to call your attention to the sketch-map, on which are shown the several snowy groups which constitute the culminating portion of the Ruwenzori range, together with its passes and valleys. This map is based on observations carried out often under unfavourable atmospheric conditions and not always with instruments of great precision; but, having regard to the number of observations on which it is based, I believe it will be found approximately correct.

Some of the mountains were seen by Stuhlmann from the west, or by Johnston and Moore from the east. Stuhlmann gave them both native and German names, Johnston only native names. In some cases confusion has been caused by one mountain having three names: a German, Semper, and two native, Kiyanja on the east, Ngemwimbi on the west. On my return from Africa, I had the pleasure of meeting Sir H. Johnston and Dr. Stuhlmann, and discussing with them this knotty question of nomenclature. The question was somewhat delicate, but we resolved it easily, because we found ourselves in agreement. To give native names seemed undesirable, because the natives do not distinguish the peaks, but only the valleys. In giving European names, the better course appeared to be to use, for the several groups, the names of explorers connected with this region. Dr. Stuhlmann begged me to leave the names he had introduced to individual summits, and I have yielded with pleasure to this suggestion.

I propose, therefore, to call Mount Stanley the mountain or massif that carries the five highest peaks—Margherita (16,816 feet), Alexandra (16,750 feet), Elena (16,388 feet), Savoia (16,340 feet), and Moebius (16,214 feet). To the second group in order of height, the Duwoni seen from Ibanda, I give the name of Speke, in memory of the discoverer of the Ripon Falls, the origin of the Nile; and the highest peak of this massif I call after the King of Italy, Vittorio Emanuele (16,080 feet); and the lower and more southern seen from the lower Mobuku valley I

name after Sir H. Johnston (15,906 feet). To the third massif (Semper, Kiyanja, or Ngemwimbi) I give the name of Mount Baker, in memory of the traveller who discovered Lake Albert, and was the first to see these mountains, calling its highest point (15,988 feet) after the King of England, and the lower to the west we first climbed Mount Semper (15,343 feet). The fourth massif I call Mount Emin, after the traveller who succeeded Stanley in this region; its highest points Umberto (15,807 feet) and Kraepelin (15,752 feet). The fifth massif I name Mount Gessi, after the Italian traveller who first circumnavigated Lake Albert; and I name the two points of this group Yolanda (15,647 feet) and Bottègo (15,483 feet). To the sixth massif I give the name of Thomson,* in honour of the traveller to whom we owe the progress of civilization in these countries, naming its peaks Weismann (15,273 feet), Sella (15,286 feet), and Stairs (15,060 feet). For the point climbed by Dr. Wollaston, and thought by him to be Duwoni (15,286 feet), I propose the name of its climber; for the northern top (15,269 feet) that of Moore; the name of Cagni for the rock-peak opposite Bujongolo (14,826 feet).

I have left their native names to the valleys, torrents, and lakes, where these had any single name given them by the Bakonjo; where they differed, and in the case of all the valleys, lakes, and torrents on the Semliki slope, of which the Bakonjo know little, I have given no names.

I have called the passes we visited after Freshfield, Scott Elliot, Stuhlmann, Cavalli, and Roccati, leaving nameless the gap between the Yolanda Peak and the Portal Peaks, because I could not exactly determine its position. These passes range between 13,780 and 14,180 feet, except the Stuhlmann Pass, which is slightly lower.

The watershed runs from the Weismann Peak over the Freshfield Pass to the King Edward Peak, follows the crest to the east as far as the Scott Elliot Pass to climb over the summits of Mount Stanley, then by the Stuhlmann Pass to the Vittorio Emanuele Peak, whence by the Cavalli Pass to the Umberto Peak, and so by the Roccati Pass to the Bottègo and Yolanda summits. It then follows the ridge that drops from the Yolanda to the south-east to join the Portal Peaks, and from these turns again north-east.

The waters of the Bujuku are fed by the principal glaciers of the Stanley, the Speke, and the Gessi groups, and are more considerable than those of the Mobuku, which receive only the glaciers of the Baker. The Mobuku, therefore, ought to be considered a tributary of the Bujuku, and the lower valley ought to be known as the Bujuku. The pass at its head is also lower than that at the head of Mobuku.

Even when the weather was fine, the distances in the views from the higher peaks were always more or less veiled by haze, which made it difficult to determine the direction of the valleys falling towards the Semliki. It may, however, be pointed out that the four valleys leading

* See footnote, p. 121.

QUEEN MARGHERITA AND QUEEN ALEXANDRA PEAKS FROM LAKE BUJUKU.

to the Freshfield, Scott Elliot, Stuhlmann, and Cavalli passes all unite to form the Butagu. The Butagu draws its waters from the glaciers of Mount Stanley (except the Margherita Glacier), from those west of Mount Baker, from the Thomson Glaciers, and a good part of the Speke and Emin Glaciers. It is, therefore, the most important torrent of the western slope. The Wimi is not a glacier stream. The Nyamwamba, Russirubi, and Rudma may be fed by the glaciers on Mounts Thomson,* Emin, and Gessi.

I now return to the events of June 18, on which we climbed the two highest peaks. On the 20th we again climbed the Alexandra, and then went on to the Elena and Savoia, returning directly to our camp by a large couloir below the Savoia. On the same evening Cagni, Sella, Cavalli, and Roccati arrived in camp, Cagni looking very well and delighted to join us. His fever had allowed him, not only to recover rapidly, but to make the march from Entebbe to Bujongolo in twelve days. This and the following day we held festival.

On the 22nd we again separated. Sella and Roccati remained at the camp to climb Mount Baker; I and the three guides, with some Bakongo, started to climb various snowy summits, the King Vittorio Emanuele, Umberto, King Edward, Stairs, Wollaston, and Moore peaks. This we accomplished between June 22 and July 10. Fine weather favoured us only in the final days. We twice climbed the Speke and King Edward Peaks; we remained for eight hours on the Umberto without seeing anything. Our negroes lacking provisions, we were forced to return from our seventh camp to Bujongolo, marching for three days under rain. From the Stairs Peak we had a splendid view of the King Edward and Wollaston and Moore peaks. These ascents were all easy; we found the rocks easy and the snow in perfect condition. Even on the Margherita Peak the difficulty we encountered could easily be avoided by taking the eastern ridge. On our return to Bujongolo, we could feel satisfied that we had completely explored this side of the chain; the highest peak and thirteen others had been climbed, and the heights of all of them determined.† Cagni had finished his magnetic observations, measured a base

* See footnote, p. 121.

† With the exception of the Yolanda Peak, the height of which is the result of boiling-point readings, all the heights depend upon mercurial barometer observations referred to Bujongolo as a lower station, the height of Bujongolo above Fort Portal having been previously determined by a series of barometer readings extending over a month, reduced as nearly as possible to the same time, at each place. The height of Fort Portal above Entebbe was in the same manner determined by a comparison of mercurial barometer readings taken at these two places, but in this case the series of readings extended over a period of three months. The following are the figures for these three places:—

Entebbe	3862 feet (barometer cistern)
Fort Portal (near Collectorate) ...	5026 feet (barometer cistern)
Bujongolo	12,461 feet.

The height of the barometer cistern at Entebbe depends upon the surface of the lake

near Bujongolo, and connected with this the King Edward and Cagni peaks. He had also climbed the last named, and connected it with those I climbed. He had fixed the geographical position of one of the extremities of the base. Sella had succeeded, by means of admirable perseverance, in obtaining views and panoramas from the King Edward and Stairs peaks and the Grauer gap. To secure good photographs on the peaks of Ruwenzori is no easy task. If the air is sometimes clear in the early morning hours, the light is insufficient; and when the light becomes good, the clouds have risen. It may be enough to say that in order to take the panorama from the King Edward Peak shown here, Sella had to camp for a week close to the Freshfield Pass, and to climb the peak several times to secure the favourable moments.

We now resolved to leave Bujongolo and descend to Ibanda, Cagni and Roccati, by the Mobuku path, Sella and I by the Bujuku. Crossing the Scott Elliot Pass, in two marches we descended to our ninth camp, situated at the point where the Bujuku receives its tributaries, the Mijusi and Kurungo. After July 4 fine weather set in. The soil dried, and our marches became less laborious. From our camp the peaks of Mount Gessi were visible at the head of the Mijusi valley, and we could not make up our minds to abandon this region without climbing them. One day's march took us to the foot of the Yolanda Peak, and on the next day we climbed it and the Bòttego. Owing to the clearness of the day, we could distinguish the watershed running north-east from the Portal Peaks, in a chain lower than the Portal and without permanent snow. To the north-west we had the King Vittorio Emanuele Glacier, the largest of the group. On the east, both Mount Emin and Mount Gessi have no glaciers of any size. The Margherita, Alexandra, Savoia, and Elena peaks were all in sight, and appeared over those of Mount Speke. The snowy summits of a chain, until within the last two decades shown only on the maps of ancient geographers, rose before us. We gazed long on the shining glaciers of the Nile which have through the centuries fed the sources of the majestic river linked to history by so many records of the past, and we bade farewell reluctantly to the virgin summits which we had been the first to subdue.

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being 3726 feet, but according to Captain T. T. Behrens, R.E., of the Anglo-German Boundary Commission, the lake is only 3720 feet.

As the height of Fort Portal, which was our first station to be determined after leaving Entebbe, has not yet been definitely fixed trigonometrically, some correction may have to be made to the height of Bujongolo, which depends upon Fort Portal, and consequently to the heights of the peaks depending upon Bujongolo; but probably the necessary correction will, in any case, be small, since the barometric results agree (with one exception, for which reasons can be given) within 100 to 200 feet of the trigonometrical determinations of Captain Behrens. In addition to the barometer observations, Captain Cagni fixed the height of the Cagni Peak above Bujongolo by theodolite vertical angles, and from the summit of this peak took vertical angles to the other peaks. The heights resulting from these observations agree very closely with the barometer determinations.

KING EDWARD PEAK, SEEN FROM THE N.W., FROM THE CAMP, N.W. OF SCOTT ELLIOT PASS, NEAR THE ELENA GLACIER.

We descended from camp nine to Ibanda in two marches. We admired for the last time the bushes covered with white everlasting bloom, the branching senecios, the delicate lobelias. Lower down we again encountered the gigantic heaths, the bamboos, the podocarpus, and the laurels. At Ibanda we parted from our brave and faithful Bakonjo, who had been for forty days our companions. The Bujuku valley is longer and more tiring to traverse than the Mobuku, but running as it does to the base of the principal snow-peaks, may be recommended to mountaineers anxious to visit the heights.

On July 21 we were at Fort Portal. The weather remained fine, but the haze cut off all view of the higher range, and we saw it no more. We remained ten days at the Fort, occupied in an elephant hunt in the Kibale forest and in visiting the crater lakes near the station. On August 14 we reached Entebbe, after crossing in canoes a narrow inlet of Lake Victoria. We landed at Jinja to see the Ripon Falls, and thence returned home by the way we had come, reaching Marseilles in the middle of September.

I may add some notes here on the geological structure of Ruwenzori. The theory of a volcanic origin may be absolutely excluded. In the whole upper region visited there exist only at one point, in the neighbourhood of Kichuchu, traces, and those entirely local, of basaltic veins in the gneiss rock.

The dip of the strata, often very high—inclined up to 60°—is, as a rule, east or south-east in the eastern portion of the central group, completely arched towards the south, and tending towards south-west in the western portion so as to form a kind of semicircular outcrop.

The origin of the mountain group of Ruwenzori and of the high peaks of its central portion may be attributed to three causes—geotectonic, stratigraphic, and lithologic—as follows :—

1. To an upheaval *en masse* of a portion of the archæan floor of Central Africa, producing a general dip from west to east in connection with the great western fracture (with corresponding vertical displacements) which produced the valley of the Semliki, as well as with the other fractures observed to the east of the group, which are marked by a series of recent volcanoes, of which those of the province of Toro are examples.

2. To a highly accentuated ellipsoid of upheaval or anticlinal, with strata more or less strongly tilted in the Ruwenzori group, an ellipsoid having its general direction north and south.

3. To the presence in the heart of the group of a series of rocks (namely, amphibolites, diorites, diabases, amphibolitic gneiss), admirably fitted to resist denudation by surface agents, both physical and chemical, to which the gneisses and mica-schists of the outer ranges offer far less resistance.

To these main causes may be added the probable existence of internal fractures, traversing the *massif* in a generally north-and-south direction, which would tend to the separation of the several groups of summits.

An important geological phenomenon in the Ruwenzori range, is the enormous development of its glaciers in the glacial epoch. Of this period we found evident traces before arriving at Bihunga, and still more at Nakitawa. In past ages the valleys of the Mahoma, Mobuku, and Bujuku were filled with glaciers of the first order which united below Nakitawa and descended beyond Bihunga. Again on the western side the Savoia, Elena, and Semper glaciers must have filled the depression between the Stanley, Baker, and Thomson * groups, and probably united with the King Edward glacier. To what point they reached on the western slope I am not in a position to determine, as we were unable to visit that side of the chain.

At present the glaciers are of small extent and all in retreat. This is proved in some glaciers by the existence of recent moraines at a few hundred yards in front of the present ice, and by the freshness of the abrasion of the soil in the neighbourhood of almost all the glaciers.

There are no glaciers of the first order in the principal valleys, but only glaciers of the second order on the upper slopes and in the larger ravines. These are not of the type of simple snowfields, but true glaciers. Unlike our Alps, there are no extensive gathering-grounds, no *névés*, but a series of ice-caps which stretch out in diverse directions glacial fingers. We have in the higher groups of Ruwenzori glacial features which remind us of the Scandinavian type, and have sometimes been described as tropical glaciers. The glaciers that descend lowest are the Mobuku and the Semper, which reach respectively 13,682 and 14,335 feet. The larger glaciers are formed on Mounts Stanley, Speke, Baker, and the eastern side of Gessi. On Mounts Emin and Thomson,* unless there are important glaciers to the north and south which we did not see, the glaciers are of less extent. The permanent snows are included in a circle 10 miles in diameter. On the tops of the range, besides the enormous cornices, we noted a new feature in the huge icy stalactites which seemed to bear up these cornices. The cause of these pillars of ice becomes obvious when one considers the high temperatures often experienced on these summits (sometimes 42° to 44° Fahr.) and the rapid changes in temperature. The highest temperature we had on King Edward Peak was 43° Fahr., and the lowest on the Queen Alexandra Peak 26° Fahr. At Bujongolo the thermometer varied from 50° to 32° Fahr.

Most of our predecessors had found the snow-level at about 13,780 feet, while David and Freshfield, with whom I agree, put it 650 feet higher. This limit corresponds with that to which the glaciers descend on the mountain flanks.

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* See footnote, p. 121.

MOBUKU VALLEY BETWEEN YOLANDA AND BIHUNGA AND PORTAL PEAKS.

Rain invariably changed to snow at 14,100 feet. In certain spots in the valleys we observed small levels covered with nothing but grass, plains of lacustrine alluvium caused by stratigraphic conditions, and by barriers of rock more compact than the rest, which anciently barred here and there these valleys, producing above the obstruction a collection of water and special lacustrine deposits, which in time become converted into plains more or less marshy. Lake Bujuku is a good example of a remnant of one of these ancient lacustrine regions.

In the Mobuku and Bujuku valleys, about 10,000 feet, the constantly wet and warm climate produces in especial mosses, Hepaticas, and lichens which cover the faces of the crags and the soil, and conceal the innumerable trunks both of living plants and of those that have fallen from decay. At this elevation the valleys are covered with a luxuriant growth of tree-heaths, laurels, tree-orchids, and ferns, in whose shade grow violets, ranunculuses, geraniums, willow-weed, umbellifera, and thistles.

At about 11,500 feet a number of the plants of the lower region fail, and the trees are limited to the gigantic heaths, Lobelias and Senecios, while the ferns, mosses, Hepaticas, and lichens take the principal place. They reach their greatest development at about 12,000 feet, just before the heaths come to an end. Higher up we find only Senecios, *Lobelia*, and on the ground mosses, Hepaticas, and lichens.

Here the Helichrysums, which had already began to grow at 11,500 feet, form large bushes, and continue up to the glaciers, where with the Senecios they are the highest shrubs.

On the peaks we found a few mosses, lichens, some rare germinaceæ, and a very few dwarf phanerogamous plants, which reminded us of the vegetation characteristic of our Alps. Among the botanical collection made, we have reason to anticipate not a few novelties.

The expedition had not proposed to make special and minute researches into the fauna. Still, as far as the rapidity of the march and the nature of the ground allowed, we collected what animals we could, aided by the effectual help of the Catholic missionaries. As we ascended the Mobuku the fauna became poorer, and above Bujongolo we saw nothing but leopards, bats, moles; very few birds, crows, falcons, and insects and worms. On the peaks we found worms, *Hemoptera*, and *Diptera*.

The collections promise, on first examination, an abundant harvest, not only of species interesting under various aspects, but also of species new to science, particularly among the birds, molluscs, insects, and crustacea.

I have to thank all my companions for the aid they invariably gave me towards the success of the expedition, and to help it to make some modest contribution to science. I have also to thank the English Government and the local authorities of British East Africa and Uganda for the orders given for my benefit and the facilities granted me, which

contributed greatly to the success of our undertaking. By means of the splendid photographs of Sella, the peaks of the Ruwenzori chain will lose their mystery. And these peaks, if they are not the highest in Africa, as some formerly believed, are the culminating points of a range of the greatest importance in the study of the geology and of the glacial phenomena of the African continent.

Before the paper, the PRESIDENT :—

It is customary at these meetings for the President of the Royal Geographical Society to open the proceedings with a brief reference to the lecturer of the evening, and especially with regard to his previous explorations and geographical achievements. To-night that agreeable duty does not devolve upon me, because we are honoured by the presence of the supreme authority of the Society, our august Patron the King. But this very fact imposes upon me another duty; for there are present here to-night an unusually large number of strangers to our Society, as also, doubtless, many Fellows who have joined our ranks during the past few years, and I think they ought to know that, although His Majesty was frequently able to attend these meetings when he was Prince of Wales, during the nearly forty years that he was Vice-Patron of our Society—just as His Royal Highness the Prince of Wales has been Vice-Patron since His Majesty's accession—and although her late Majesty Queen Victoria was Patron of our Society during her long and glorious reign, yet this is the first time that we have ever been honoured by the presence at these meetings of our reigning Sovereign. I should fail in my duty to our Society if I were to omit to give expression to the loyal and deep satisfaction which this unprecedented event will arouse, not only amongst the Fellows present, but amongst that far larger body of Fellows who are scattered over the world-wide empire of King Edward VII. By command of His Majesty, I now invite that most energetic explorer, that born leader of men, that most careful and admirable organizer of expeditions, whether in the temperate regions, or the Arctic regions, or the equatorial regions, our Gold Medallist of 1901, His Royal Highness the Duke of the Abruzzi, to read his paper.

After the paper, HIS MAJESTY KING EDWARD VII. :—

I feel convinced that I am expressing the wishes of the Royal Geographical Society, as well as those of the large assemblage to-night, when we tender our thanks to His Royal Highness the Duke of the Abruzzi for the interesting and exhaustive lecture which he has just given us. He has travelled a long way for this purpose, and it has been, no doubt, a great strain on his voice; but I feel sure that all of us will go home fully impressed with the admirable manner in which this

expedition was fitted out and the successful results which it attained. We have been interested and helped by the lantern slides which have been taken from the photographs of the distinguished Mr. Sella who accompanied the duke on this expedition, and I am sure everything we have seen has brought before us as vividly almost as if we had been with him, the adventures, the successful adventures, he experienced, and his success in surmounting these high peaks of the Ruwenzori. But his Royal Highness is a great traveller and a great explorer. He has done even more than what he has told us to-night. If I refer back to ten years ago, he organized an expedition to attempt the ascent of a still unclimbed peak—that of Kangchenjunga, the second highest mountain in the world. Owing to the outbreak of plague in India, difficulties arose which led him, I believe, to leave Darjiling and turn his attention to Mount St. Elias, in Alaska, over 18,000 feet in height, which he was the first to ascend. In 1899–1900 the duke led an admirably organized expedition in an attempt to reach the north pole. One branch of this expedition attained a latitude 30 miles nearer to the pole than the record established by Dr. Nansen, and not far short of the point which has since been attained by Commander Peary. Our distinguished lecturer is, fortunately for him, a young man, and I hope he has a long life before him in which he will continue to make explorations which are of such value to geography and other sciences. He belongs to an illustrious and distinguished race—I am happy to think, good friends and allies of ours—and, above all things, he possesses great courage, great coolness, and great will. These will, I am sure, carry him through any further expeditions or explorations he may make. I thank him again in the name of us all for his lecture, and I wish him continued success in the course of any future expedition he may undertake.

H.R.H. THE DUKE OF THE ABRUZZI:—

Sire,—I am most deeply moved by the presence of your Majesty at this meeting of the Royal Geographical Society, and by the flattering words just addressed to me. No praise could be more gratifying than this, coming from King Edward VII., from the noble-minded Sovereign of the nation which has always taken the lead in every kind of daring discovery and geographical enterprise, over land and on sea, from the equator to the poles. The hearty reception given to me in this country by your Majesty, your Royal Highness, and the Geographical Society will remain one of the dearest recollections of my life, and will be highly appreciated by all Italians.

THE SEYCHELLES ARCHIPELAGO.*

By J. STANLEY GARDINER, M.A., Fellow of Gonville and Caius College, Cambridge.

The Seychelles archipelago consists of twenty-nine islands, situated about 575 miles to the north of Madagascar, 1500 miles to the south-west of India, 1725 miles from Aden, and 1100 miles from Zanzibar. With the exceptions of Bird and Dennis, they lie towards the centre of a large bank, included within the 50-fathom line, almost within sight of one another, and are of granitic formation, rising into hills, which vary in height with their size. Mahé is the biggest, covering an area of about 53 square miles, and rising to 2993 feet. Praslin is 27 square miles and 1260 feet high, Silhouette 8 square miles and 2473 feet, and La Digue 4 square miles and 1175 feet. The other more important islands are Frigate,† Curieuse, Félicité, East Sister, and North. These have all extensive plantations with considerable labour settlements, while the rest have, for the most part, one or two families, which make a precarious living by fishing, the collection of birds' eggs, etc. They also scrape up a certain amount of guano from the surface of the granite, and sell it to planters in Mahé and elsewhere. La Digue, Praslin, and Mahé differ from the rest in not being the separate estates of private proprietors, but being divided up between many owners, in fact, in alone having peasant proprietors, who acquired rights originally by squatting on the land. They occupy 84 square miles, and are the most fertile part of the group, so that on their economic condition really depends its prosperity. Bird and Dennis islands differ from the rest in being formed of organically produced limestones, thrown up (or upheaved) on the edge of the bank to the north. Their French names, Île Oiseaux and Île Vaches Marines, show their former peculiarities in being the homes of birds and dugongs. The former have departed, and the latter have been killed off. The best of their guano has been scraped up, and the islands themselves are now being planted with coconuts, the drying of fish being a subsidiary industry. Bird island has a good lighthouse, which marks the passage over the edge of the bank to the north, the channel between the islands being quite free from dangers, 22 miles broad, with over 30 fathoms of water.

The group was under Mauritius until 1903, when it was separated and made a distinct Crown colony. It was then given as dependencies, the Amirantes, Desroches, Platte, Alphonse, Providence, St. Pierre, Astove, Cosmoledo, Aldabra, and Assumption, the last two being about

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* Read at the Royal Geographical Society, November 12, 1906. Map, p. 248. This paper deals with the Seychelles in other aspects to the same author's paper in the *Geographical Journal*, October and November, 1906, pp. 313–332 and 454–471.

† This island lies to the south-east of the group, and is not included in the large chart at the end of this number.

80 miles to the west of Cosmoledo and Astove. These are all separate islands or island groups, with the exception of the Amirantes, which includes six inhabited islands—Marie Louise, Poivre, Darros, St. Joseph, Eagle, and African. Thus, in the division, there were included with the Seychelles all the islands towards Madagascar, with the exceptions of Coetivy and Farquhar, which remained attached to Mauritius on account of their proprietors belonging to that island. The former is an outlying island of the Seychelles archipelago, being only 130 miles from Mahé, and Farquhar is almost on the track to Cosmoledo and Astove. Both recruit their labour in the Seychelles, and ultimately must be transferred to its government. A further advantage in such a change would lie in

VIEW FROM CHATEAU MARGOT, LOOKING NORTH ALONG THE RIDGE OF MAHÉ, WITH MORNE SEYCHELLOIS AND TROIS FRÈRES.

the fact that the Seychelles is out of the hurricane zone, whereas their present headquarters is almost in its worst belt. For similar geographical reasons, the Chagos archipelago sooner or later must be attached to the greater land masses either to the north or to the west, to Ceylon or to the Seychelles. Winds, currents, and distances favour the latter, as well as the negro character of its labour. Finally, if one may prophesy, in the process of consolidation which is going on everywhere, East Africa will claim sway over the Seychelles, probably greatly to the advantage of both colonies.

The Seychelles may be considered almost unique, in the fact that it has no human history, in that it possessed no regular inhabitants before the advent of Western peoples. It may have been known to

early Arab traders, but it is altogether unlikely that its existence can ever have been a matter of common knowledge to their navigators. To the Malays it would have been too far south for any wind or current to have shown them of its existence; while, if known to the Arabs, we must conclude that its inhospitable waterless islets and reefs towards Madagascar caused a shunning of the whole of its region and a course right along the African littoral. Yet, the absence of indigenous inhabitants from Mauritius, Chagos, Bourbon, Rodriguez, and Seychelles, not to mention a host of small islets and groups, is an extraordinary fact as compared with the vigorous and dense populations which at some time or other dwelt on nearly every islet in the Pacific ocean.

The first white discoverers of islands in the vicinity were undoubtedly Portuguese navigators, at some period towards the end of the fifteenth century. The Cape of Good Hope was rounded in 1487, and M. A. A. Fauvel has shown that the group first appears on the charts of Alberto Cantino and Nicolas Caneirio in 1502. It is better represented in one of 1520, in which most of the island groups to the north of Madagascar are clearly shown. It suffices to say that it appears on eighteen charts of the sixteenth century. The islands were evidently well known, and must often have been sighted; but it is an extraordinary fact that we have, in the first two and a half centuries after their discovery, only one record of any visit.*

Silhouette was sighted by one John Jourdain (who left a journal) on January 19, 1609.† The skiff was on the following day sent off to North island; "butt because our men made noe signe of any water we ankored not. Soe the boate retourned and brought soe many land tortells as they could well carrie. Soe we stoode alonge towards the other islands. The tortells were good meate, as good as fresh beefe, but after two or three meales our men would not eate them, because they did looke soe uglie before they weare boyled; and soe greate that eight of them did almost lade our skiffe." Praslin, Mamelle, and other islands were seen, but finally they came to anchor at Port Victoria on January 21, remaining there until the 30th, while they watered and obtained firewood. In particular, Mahé is stated to have had much large and "very firme timber." . . . "It is a very good refreshing place for wood, water, coker nutts, fish, and fowle, without any feare or danger, except the allagartes; for you cannot discerne that ever any people had bene there before us." Jourdain's shipmates, Jones and Revett, recommend the group for refreshing ships' crews, etc. Both

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* *Vide* "L'Archipel des Seychelles; Étude de Cartographie," *Revue Française de l'Étranger*, etc., t. 17, p. 433, 1893. Also "La Découvertes des îles Seychelles d'après des Documents inédits," *La Géographie, Bulletin de la Société de Géographie*, t. 1, p. 289, 1900, by the same author.

† The *Journal of John Jourdain*. Edited by Wm. Foster, and issued by the Hakluyt Society. Pp. 46–50, 349–350 1905.

refer to the large number of almost tame doves, but neither to the crocodiles. Revett mentions "land turtles of so huge a bidgnes which men will thinke incredible; of which our company had small lust to eate of, beinge such huge defourmed creatures and footed with five clawes lyke a beare."

The next visit was that of Captain Lazare Picault's expedition in 1742, later by 133 years. It may be supposed that this neglect of these lands was due to the fact that they were uninhabited, and therefore had no trade, the chief object of early navigators. The land appeared rocky and inhospitable, the anchorages and approaches bristling with dangers,

DOUBLE COCONUT TREES IN THE VALLEY OF THE COCO DE MER PRASLIN, REPUTED TO VARY UP TO 800 YEARS OLD.

the vegetation entirely new, and therefore worthless. Perhaps the piracy that flourished around Madagascar caused an avoidance of these seas. There are also legends in the Seychelles, among the older Mauritian families, of the group having been the headquarters of many adventurers. These do not, as far as I could ascertain, rest on any basis of historical fact, but there are possibly on Praslin and Frigate * the remains of pre-European structures. The tradition is that there was, in Praslin, a pirate settlement and station for repairs, and that one of the

* Mr. Connor, the owner of Frigate island, examined it at our request, and found the remains of a stone erection. He also states that within the reef there is a basin with a passage to the same, that might have been used for repairs.

bays on the north side, Côte d'Or or Curieuse, was used for this purpose.* Certain works, which might have been of the nature of forts, and supposed artificialities in boat channels were pointed out to us, but they did not seem capable of being dated.†

As general evidence of their statements, the people of Praslin point to the burnt stumps of massive trees, mostly gayac (*Afzelia bijuga*) and takamaka (*Calophyllum inophyllum*), and to marks of fire on the double coconut, or coco-de-mer (*Lodoicea sechellarum*), which is confined to that and the neighbouring island of Curieuse. The former cannot be dated, but, taking known rates of growth of the latter, we have some evidence of fires at least two hundred years ago. Many of the older coco-de-mer are scarred at their bases, as if by fire, but the trees relied on show a ring at about 10 feet above the ground. This is stated to have been formed by the burning of the dead stems of the leaves below the living crown of the palm, which was not killed. Five trees were strikingly similar in height above this ring, but the supposed age of their new growth may be quite erroneous. Together with the burnt stumps, etc., they, in any case, give evidence of great forest fires extending all over Praslin, and causing devastation which must have profoundly modified both its fauna and flora, quite sufficient to account for its scantiness as compared to those of Mahé and Silhouette, on which there is no evidence of such conflagrations.

The two journals, which still exist, of Captains Grossin and Picault's expedition are interesting as showing the existence in Mahé of land tortoises, which are clearly distinguished from "tortues de mer," the latter being noted as all of the valuable shelled variety, *i.e.* "carets" (*Chelone imbricata*). Revisiting the group in 1744, Captain Picault formally annexed the large island, calling it Mahé, and the group "Les Iles de la Bourdonnais," both after the then governor of Mauritius, Mahé de la Bourdonnais. He also prepared the first chart, which comprised thirty-three islets, etc. The annexation was completed in 1756, when the name was changed to "Sechelles," after Moreau de Séchelles, Contrôleur des Finances, 1754–6. Careful charts were made of Port Victoria, then called "Port Royal." Frigate island, termed "Ile Annonciation," was at that time discovered. In 1768 Praslin was formally annexed by

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* Where a legend is universally spread, experience leads us to believe that it rests on a basis of truth. We therefore mention it in the hope that further references may be discovered to the Seychelles, when fresh journals of voyages in the Indian ocean come to light, as recently has that of John Jourdain.

† We were lent, by Mr. Bouton, of Côte d'Or, Praslin, a curious pamphlet entitled 'Histoire et Description des Îles Seychelles,' par Charles Anastas (Maurice, 1897), which gives most circumstantial details of the early history of the group. Unfortunately, he does not mention his authorities, whose views and statements, we think, must be as yet unpublished. Of the European pirates, who followed the Arabs, he mentions the names of Boynot, Taylor, Coudent, Egland, and Olivier le Tasseur (La Buze).

M. Duchemin and M. Lemperière, the neighbouring islands of La Digue and Curieuse receiving names from their vessels.

In 1769 a further expedition, under M. du Roslan, visited the group. The Abbé Rochon, who was on board, fixed the position of Mahé, and remarks * that the "Secheyles and the adjacent isles were inhabited only by monstrous crocodiles; but a small establishment has been since formed in it for the cultivation of nutmegs and cloves. In one of these islands, called the Isle of Palms (Praslin), there is found a

VIEW ALONG NORTH SIDE OF TROIS FRERES. WATER-WORN CLIFFS, WITH *PANDANUS HORNEI* IN FRONT, DEAD CAPUCIN (*NORTHEA SECHELLARUM*) BEHIND, AND JUNGLE LARGELY FORMED BY CINNAMON.

tree which bears that celebrated fruit known by the name of the cocoa of the Maldives, or 'coco-de-mer.'" It was in the course of this expedition that the Amirante group was traversed, and its separate islets named. Silhouette was, so far as we know, for the first time visited, and was remarked upon for its richness and the large number of crocodiles and sharks around its coast. La Digue would also appear to have been

* English edition, 1792, p. lii.

examined by Charles Oger,* one of the officers of the same expedition, who is said to have captured a crocodile (caiman) 30 feet long by 8 feet round, and to have found also "une couleuvre capelle d'une grosseur extraordinaire."

A settlement was formally established about the same time for the cultivation of spices, and regularly visited. In 1773 Dennis island was discovered and described as "généralement couverte de tortues de terre et de mer, de vaches marines et d'oiseaux." It was covered by soft-wooded trees (probably the tanghain and mapou, as now is S. Pierre, Providence), in which were vast numbers of birds, which no doubt formed the guano, up till recently being regularly worked. The *Eagle*, of Bombay, on a voyage for coco-de-mer, is said to have set fire to Curieuse, and certainly visited Bird island, where the large number of sirenians and birds was noted. Platte and Coetivy islands, which do not actually stand on the Seychelles bank, were discovered in 1769 and 1788 respectively.

Most of the larger islands appear to have speedily become more or less populated from Mauritius, in 1777 there being twelve families of slaves even on La Digue, cultivating cotton and coco oil. The islands were captured in 1794 by Captain Newcome, H.M.S *Orpheus*, and again in 1805 by Captain Ferrier, H.M.S. *Albion*, being finally ceded in 1814 to England, M. Le Queau de Quinssy, who had served the King, the Republic, the Empire, the latter alternating with the English Government (when H.M.'s ships were visiting the islands), still continuing to administer them. They were at that time placed under the government of Mauritius, and continued to be so until 1903, as already mentioned.†

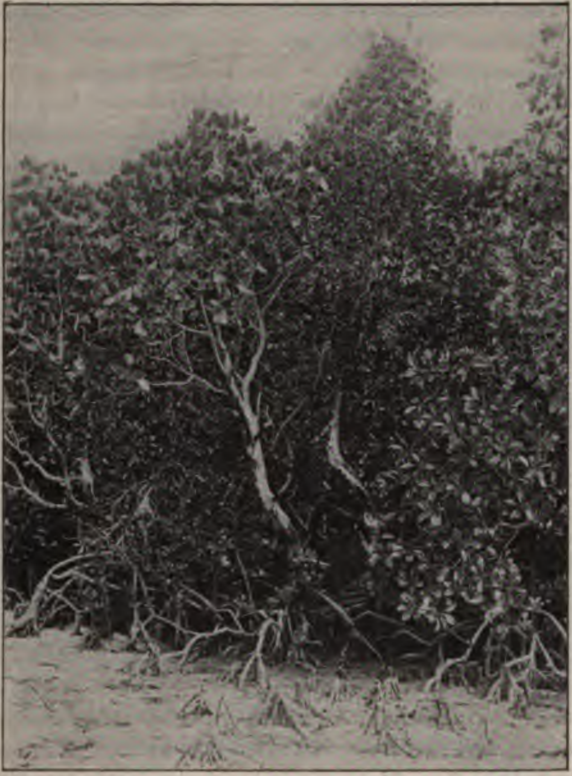
The present population of the Seychelles, which numbers about 21,000, has been made up of French and Anglo-Saxon elements, with blacks of different sorts from India, Madagascar, and every part of Africa; a few Chinese shopkeepers are recent immigrants. Up to about 1825 its constitution was practically the same as that of Mauritius, and its aristocracy was simply formed of the descendants of younger branches of Mauritian families. In the "society" of the islands at the present day are found such of these as have continued to keep their families untarnished—there are remarkably few that have done so—together with the pure-blooded descendants of such English officials and planters as have settled on the islands since their annexation. It is in every way a charming society, but its tone of thought, its pride (owing to poverty) amounting almost to exclusiveness, and its lack of energy, is such that to it the English are scarcely admissible, and that it is of little value to the country as a whole. Its position would be

* *Vide* Charles Anastas, *loc. cit.*

† M. de Quinssy was buried in Government House garden, Mahé, where his tomb still stands.

better understood by reference to the land laws; but one may say in passing that, owing to the spread of education, it shows signs of an awakening, which, if encouraged, may well make its children of great use, not only to the colony itself, but also in the development of East Africa as well.

The coloured classes, with the exception of the few Chinese traders, consist, firstly, of the descendants of slaves, introduced from Mauritius. These would appear to have been mainly negroes from Madagascar and



MANGROVES OF THE COAST (*CERIOPS CANDOLLEANA*, WITH *RHIZOPHORA* IN FRONT AND *BRUGIERA* TO THE RIGHT).

the Cape. There were, however, some Indians among them, and from time to time additional ones have been introduced for domestic service, etc., themselves or their descendants drifting finally on to the land. Altogether the Indians can scarcely have ever numbered more than a few hundred, but they made a considerable impress on the race, one not always distinguishable from that of white races, this complicated by the fact that they were of saving propensities, and bought or cleared stretches of land. Lastly, there were in the middle and the second half of the last

century, negroes introduced from captured slave dhows, brought together by raiders from every part of Africa to be sold in Arabia and Persia. The exact number of these it is difficult to estimate, but it is supposed that there cannot have been less than 5000, mostly males. Many of these, and some also of the negroes on their release from slavery on the plantations, took to the high lands and jungles of the larger islands. They cleared patches of the forest, and planted bananas, yams, and other vegetables. Most isolated themselves as much as possible, and it is not uncommon to find in such jungles as remain patches cleared by them. The descendants of a few still retain their lands, but most have been ejected, or bought out, owing to their propensities for thieving and elevating liquors.

The black inhabitants now divide themselves into four classes—those who own land, separated further into those who have and those who have not Western blood, and those who have no land, "enfants des îles," and foreigners. There are a very considerable number of the first subdivision, owing to the Code Napoleon being the law of the country, whereby illegitimate children, if recognized (even when of considerable age) by their male parent, are entitled on his death to shares in his property. The second class of landowners are mainly descendants of Indians, with a few negroes. Most of the "enfants des îles" are of negro or mixed negro and Indian origin, while the foreigners are mostly negro slaves from captured slave dhows, often with characteristic tribal marks. These latter sections form the plantation population, but they differ in that the "enfants des îles" settle down in one place, whereas the negroes are always changing masters, taking any new job that offers for the sake of variety. The former have generally received some sort of education in childhood, but the latter are quite ignorant. They make, though, the best labour, being in every way more honest and truthful, though requiring to be employed in piece-work.*

All the people are nominally Christians, about half belonging to the Roman Catholic Church, which has a bishop with numerous schools and establishments in the group. Of the remainder about half profess the English Church, and the other half whatever Church their questioner is supposed to belong to. About a third of the births are illegitimate. Education is mainly in the hands of the clergy, supported by grants from the Government. Its standard is very low, but there is an undenominational Government High School at Port Victoria, which is gradually improving its tone throughout the islands. The chief food of the people is rice, which used to be grown very extensively in the marshes, previous to the introduction of the beautiful though graminivorous cardinal bird; it is now entirely imported. Cassava, yams, and bananas are the chief food of the landed peasants, together with fish.

* There is an abundance of labour of both kinds. Pay varies from Rs.8 to Rs.15 per month, food included, as well as all extras.

fowls, and a little turtle and pork, the latter fattened on the pooniac left after the oil has been extracted from the coconut. Flying foxes (*Pteropus edwardsi*) are also eaten, and very occasionally tenrec, which, introduced for the blacks about forty years ago, are now a considerable pest.

The Seychelles is almost ideal as a sanatorium for nearly all tropical and other diseases, with the exception of phthisis. The south-east monsoon blows from May until October, and the west-north-west from December to March, November and April being months of variable winds. The south-east is the dry monsoon. Hurricanes are almost unknown. The average rainfall at sea-level is 100·8 inches for the last fifteen years, at 250 feet about 110 inches, and at Cascade, Mahé, 600

THE STORM-SWEPT SUMMIT OF MOUNT SEBERT, 1600 FEET. DWARFED TREES, WITH *PANDANUS MULTISPICATUS* TO LEFT.

feet 123 inches (H.P. Thomasset, nine years), while in the mountains over 2000 feet, it must exceed 150 inches; the summit of Mount Seychellois, 2993 feet, is daily covered in mist. The average monthly rainfall in the dry season, even in the mountains, does not appear to exceed 6 inches, and, as it falls mainly at night, does no more than cool the air. The temperature at the coast varies from 67° to 90° Fahr., but in the mountains frequently falls to 55° or 60° at night.

The birth-rate of the group averages 34·4, and the death-rate 17·74 (ten years). There are no fevers, nor malaria, nor, indeed, any of the regular tropical diseases. Forty per cent. of the deaths seem to be due to old age, and a second forty per cent. to the lack of knowledge among

negro mothers of the proper methods of rearing infants. There is an abundant supply of excellent water, and diseases spread by it are almost unknown. Practically all the people are vaccinated, owing to their experience of small-pox epidemics in the past. Plague is unknown. Curieuse was formerly a leper island, but the present settlement, with its average of about a dozen inmates, is on Round island off Praslin; the disease seems to be in process of being eliminated. There are several spots at 1000 to 1500 feet on the ridge, and overlooking both coasts of Mahé, which would make ideal sanatoria in the dry season, their temperatures not exceeding moderate summer heat in England, the sun always tempered by healthy breezes from the sea. With comparative ease sufficient land could be levelled for tennis, croquet, and other outdoor games; while an hour's ride would serve to reach Port Victoria, where there are excellent facilities for cricket, football, yachting, fishing, etc.

The endemic animals and plants of the group belong mostly to peculiar species, and some to peculiar genera. In a previous paper in this same *Journal* (October and November, 1906), I have already referred to both, as well as to the physical features of the islands. The fauna will be the subject of a series of separate reports elsewhere, and I would only here emphasize the former existence in the group of dugong, land tortoises, and crocodiles. There is little of the indigenous jungle left, and we only found traces of the real invertebrate fauna. It was probably as peculiar as the flora, and may best be compared to that of the Sandwich islands. The most expert and longest-continued collecting would probably now scarcely reveal a quarter of the variety of animal life which the group possessed when it was discovered. We obtained our collections mainly from Mahé and Praslin, but we hope subsequently to visit Silhouette, where a considerable stretch of jungle still remains.

The jungle, as it formerly extended over the whole land, might have apparently been divided into two zones, one of which was capable of much further subdivision. First, there was the great distinction into the jungle of lands rich in lime, and that of lands consisting of almost pure granite. The former was for the most part found on flats near the sea, formed by elevation, or else sedimentary deposits from the streams aided by material thrown up by the waves (foraminifera, shells, fragments of coral, and calcareous seaweeds). Against the sea this land was, of course, excessively salt, but further in quite fresh, often with freshwater pools. Most of this area has now been cleared and planted with coconuts, but on Curieuse and behind small bays elsewhere some indications of its flora are yet distinguishable. Immediately against the sea, especially near where any swampy land occurred, were mangroves of the same species as are found in East Africa and all round the Indian ocean. Elsewhere against the sea were large trees of *Calophyllum* and *Barringtonia*, with bushes of *Pemphis*, *Scævola*, *Pandanus*, and *Tournefortia*. Behind these appeared a few large trees, banyans (*Ficus*), *Afzelia*,

Pisonia, and *Hernandia*, with shrubs of *Hibiscus*, *Antirrhœa*, *Ochrosia*, etc. Another denizen may, or may not, have been the coconut; we learn from Jourdain's and Picault's visits that there were plenty of its trees near the coasts, but it is doubtful whether they were not originally introduced.* Individual plants, mangroves, banyans, etc., may show special characters of adaptation. Many, indeed, have a marked increase in the coriaceous nature of their leaves in accordance with their proxi-

ON CASCADE AT 1400 FEET. BASE OF *WORMIA FERRUGINEA*, WITH SPREADING ROOTS.

mity to the sea; but it can scarcely be said that this flora has any particular characteristics, save absence of palms, climbers, ferns, mosses, and conspicuous grasses. Its general appearance is almost that of a luxuriant temperate dicotyledonous forest in full leaf, and its interest lies in the fact that the very large majority of its plants are the same species as one finds on any of the purely oceanic coral islands of the western Indian ocean.

* The coconut is known to have been introduced into nine-tenths of the dependencies of the Seychelles, and if it reached the latter by currents, etc., it is difficult to understand how it failed to reach them.

Very far different to the last is the granite forest, which, in its general characteristics, is almost typically that of a tropical moist district. Little of it now remains in Mahé, merely patches here and there, with larger areas on Morne Seychellois and the slopes of Mount Harrison, the whole scarcely more than 3 square miles in all. In Praslin there are only a few peaks, and they are now nearly all covered with palms, dicotyledonous trees having been almost entirely rooted out. Silhouette is much better, having almost a square mile in its centre, within which alone the bois de fer (*Stadtmannia sideroxylon*) and the bois de natte (*Maba seychellarum*) still flourish. In striking contrast to our first type of forest, nearly all its trees, shrubs, and herbaceous plants belong to species, and many to genera, peculiar to the group. The coco-de-mer is confined to Praslin—it was probably introduced by man to Curieuse—and there are certain trees, too, found only in Mahé. It would seem to be an eminently successful flora, admirably adapted in every way to the conditions of the region; but it is not one capable of withstanding such introduced plants as the cinnamon and casuarina trees, the jamrose and the bamboo. Its most important tree was the capucin (*Northea seychellarum*), the massive dead stems of which form a conspicuous feature in its landscape. It fell a prey to a green beetle (a species of *Cratopus*), probably introduced from Mauritius, which lays its eggs in its buds, the centres of which its larvæ subsequently eat out.

Any full account of the jungle would be a mere catalogue of trees, to each of which one might add notes on its special adaptation to its environment. More broadly, one might point here to a marsh with its peculiar grasses, there to a valley of the most luxuriant growths. The crown of the hill above is perchance almost bare of soil, such as the top of Mount Sebert, physiologically dry, with stunted coriaceous trees and a few succulents; or is perchance in a region of almost perpetual mist and cold, its trees, for other reasons, dwarfed and all festooned with moss.

Imagine Cascade extending behind into the endemic jungle of Mount Harrison. It is an amphitheatre opening from a gorge extending up 600 feet from the sea and spreading out into a circlet of hills, each with an almost perpendicular face, but each at some point throwing out an earth-covered buttress, either completely planted with vanilla or covered with the bracken-like *Davallia*. Between these are flat valleys, broadening in places into marshes, each with its stream. Ascending along one of the latter, we lose it in a mass of large boulders and rocks, and we find ourselves in a cañon with almost perpendicular sides, from which we see no egress save by the way we came. Yet we can surmount it almost anywhere, dodging rocks, clinging on to and climbing up the roots of a *Pandanus seychellarum*, or holding on to some liane. Practically perpendicular, it is at the same time nearly all covered with

forest. Looking at its face, we see the white trunks of trees, and, hanging down everywhere, their roots. Every crevice has its tree, and every fissure its ferns. This little flat has a *Pandanus* (screw pine), with its roots in a great cluster searching, perchance, a hundred feet below for some place to affix themselves. That one has a *Wormia*, with its broad base a mass of great roots; while its neighbour has a capucin, perhaps one branch still alive, depending on its great buttresses against the wind. Here is a bois montagne (*Uapaca griffithii*), and there a

JUNGLE ON MORNE SEYCHELLOIS, 2500 FEET. *VERSCHAFFELTIA SPLENDIDA*, WITH STILT-LIKE ROOTS, AND *ROSCHERIA MELANOCHŒTES* (PALMS), WITH SHRUBS, YOUNG TREE-FERNS, ETC., ALL PECULIAR SPECIES.

banyan, originally grown over a sandal tree (*Carissa sechellensis*), but now sending its roots, almost like immense lianes, over, down, and around the rock below. Wherever the seeds of palms may rest, they grow: the robust latte (*Verschaffeltia splendida*), with its wilderness of small stems, adventitious roots, and the *Deckenia*, beloved for its nuts and palmiste (salad made from its terminal bud).

Our toil reaches its reward at last at the summit of the ridge, where there is an irregular plateau with valleys and glens, flats within the cloud-line, and marshes the origin of many streams. All the typical jungle trees are present in amazing wealth and confusion: palms, dead capucins, but especially *Pandanus hornei*, single stemmed in the deep-soiled marshes, but arising on a mass of stilt-like roots on the rocky hills. Beneath the latter nothing lives, a mere forest of dead leaves, but elsewhere in the glens tree-ferns up to 10 feet in height make themselves conspicuous—their destruction in the last few years of drought has been appalling—covering over their smaller brethren of many kinds. A rock here is covered by a giant hart's-tongue (*Asplenium*), while a *Lycopodium* hangs down and hides one face, a *Selaginella* another. The tree-stems are covered with moss in pendent festoons, perhaps pushing out of which are the fronds of a climbing fern, while irregularities give support to many other species. Orchids are scarce and mostly inconspicuous; but on fallen capucins and on horizontal boughs, the *Roscheria* palm and various shrubs have taken up their abodes, their roots seeking the ground below. Pushing up in among the ground ferns we see clumps of *Curculigo seychellensis*, looking like beds of palm seedlings, their flat leaves coming up in bunches and forming a most conspicuous constituent of the undergrowth. The large leaves, too, of the aroid (*Protarum seychellarum*) do not allow themselves to be forgotten, while there is a wealth of growth of the seedlings of all the plants overhead, few to survive the struggle. To cloud and mist all the trees are admirably suited; a dankness and darkness that almost might be felt would appear to be their natural environment, but yet all show adaptations against the variability of nature as seen in her two seasons, wet and dry. The screw pines, palms, and ferns all direct the falling showers to their stems and roots, while the dicotyledons are all thick-leaved and capable of holding their own in drought or wet. *Wormia* admirably looks after itself; the leaves of its trees above are thick, coriaceous, and hairy, 8 to 10 inches long, while those of its seedlings below are thin and smooth, some 3 feet in length. The latter surround their weakly stems with sheaths, adaptation from stipules, natural cups of water, which keep moist the young buds of the lateral branches and the terminal shoot. Many other plants show still more remarkable adaptations, but we cannot here attempt to do justice to the scientific interest of the jungle plants any more than to the extraordinary, perchance rather sombre beauty of the jungle as a whole. As compared with Ceylon, it lacks its wonderful lianes, but gains tenfold by the wealth and luxuriance of its palms and undergrowth.

Leaving the forest, we naturally turn to a once important industry—timber, with shipbuilding. It is difficult to ascertain how far timber was exported, but in many houses in Mauritius we saw Seychelles woods, and we were also informed of shipments to India and Zanzibar.

The bois de natte, bois gayac, and the bois de fer give beautifully grained and most durable woods, and were, together with the capucin, the principal trees felled for timber. The jungle is a mixture of all sorts of trees, and there are no woods formed almost entirely of a single kind of tree as in temperate regions. Each tree had to be sought after, and the first three trees mentioned are now almost extinct, though many fallen trunks in Silhouette, never yet carried, bear evidence to their former abundance. From 1810 to 1840 there were forty-seven vessels of 24 to 420 tons built in the Seychelles, and they probably scarcely

ON MOUNT SEBERT, 1400 FEET. CLIFF COVERED WITH VEGETATION. IN THE CENTRE *PANDANUS SEYCHELLARUM*, WITH ADVENTITIOUS ROOTS 70 TO 80 FEET LONG.

form more than a third of the total number. A large number of vessels used to put in for repairs, but the whole shipbuilding industry is now extinct. The gayac gives an excellent example of how a species of tree can be practically extinguished in a locality, so that a botanist can scarce be certain that it ever really existed. It was distributed from Malay to Madagascar, flourishing equally well on siliceous and calcareous soils. Its old timber, of a rich red colour, is resistant to white ants, and

therefore sought after for house-building. It was also employed almost exclusively for the keels and principal timbers of the ships. Its smaller boards and trees were used for boats, or the canoe-like pirogues of the region, while its young growths were sought after for the handles of fish-spears. On Salomon atoll, in the Chagos, its trees covered nearly every patch of land, while it was certainly common all over Praslin. Now it is practically restricted to one islet of the former, where it is carefully preserved, and we sought for some weeks in Praslin and Mahé without finding a single tree growing wild; indeed, our own observations alone are not sufficient for us to speak of it as an endemic tree of the group.

The Seychelles have no mineral wealth, and hence depend entirely upon agriculture and fish. At first they were planted with spices—a secret establishment to cut the trade with the Far East; but these were all destroyed by fire on the arrival of a ship flying English colours, which turned out to be French. They were subsequently replanted, and exports up to 1850 consisted mainly of cotton, cloves, cinnamon, nutmegs, coffee, tobacco, maize, rice, coconut oil, timber, fish and fish-oil, sugar, and tortoise-shell. At the same time, and for many years subsequently, the neighbouring seas were the scene of an important sperm fishery, mainly pursued by American and French whalers. On cotton being superseded, a variety of products were tried, until finally vanilla was introduced. This succeeded beyond the wildest anticipations, until in 1899, out of a total export of £140,000 over £100,000 was vanilla. The jungle was at once cleared everywhere, and its vines were planted. Sometimes a whole hillside was cleared, sometimes stumps were left for supports, and sometimes the larger trees for shade. Each method at first seemed fairly successful, and good crops were secured. The plant itself is an orchid, and the seed-pods form the bean of commerce. As there is no suitable insect, fertilization has to be done by hand. Each bean is stamped with its owner's mark while still green, and the beans, when they begin to ripen, are picked, killed in boiling water, and dried in hot air. They are then sorted, put up in bundles of sixty, and sent to the European market, most going to France. Great care has to be taken in killing, drying off, and sorting, and the lack of this among native planters to some small degree accounted for the greater falling in price of the Seychelles product as compared with that of other localities. The fall in the price of all vanilla, in the Seychelles from Rs.33 per kilo in 1900 to less than Rs.6 in 1905, was another matter, and was due both to competition with the Comoros, East Africa, Mexico, Java, and other places, and to the isolation of vanillin from cloves, this being the main flavouring constituent of the vanilla. At Rs.6 per kilo vanilla just pays for growing, and the price might be slightly increased by the whole curing being concentrated in a limited number of hands. The present distress is, however, also due to a failure of crop. There may

at any time be a reaction against vanillin, an event which would once more make the growing of vanilla highly profitable, but meantime it is necessary to try and find some other product. *En passant*, however, one may point out that much of the cultivation of the vanilla is very rough, that vanilla is an orchid requiring vegetable humus and limited light, and that some of the failure in yield may be due to excessive clearing of the overgrowth and cleaning of the soil.

In any agricultural country a percentage of the profit should be put aside for the improvement of methods of cultivation, and of the stock (or plants), and also for ascertaining what other and secondary products may be grown with advantage. To the fact that this has never been

REED-COVERED MARSH, WITH *PANDANUS HORNEI*, SINGLE-STEMMED IN ITS DEEP SOIL.

done in the Seychelles until the last two or three years, that colony owes its almost continual waves of prosperity alternating with waves of great depression. Of course, these can never be entirely avoided in any agricultural community, but the establishment of botanic and economic departments in most tropical countries has ensured that the hollows of the waves shall be considerably lessened in depth. The botanic department, under Mr. Dupont, has now found a substitute for vanilla in Para rubber, *Hevea brasiliensis*, which promises to yield, if somewhat less profitable, certainly more durable results than vanilla. The rainfall and soil are not dissimilar to the parts of Ceylon and the East Indies where it is known to flourish. Much of the land at present in vanilla appears suitable, and all conditions seem favourable. Lastly,

there are now enough trees scattered all over Mahé and Praslin to prove, by their luxuriant growth even on relatively steep slopes and scanty soil, that it is eminently a product suitable to the country. Of course, it takes five or six years to establish, and even the grade of the milk is uncertain, but its commercial success would seem assured.

The most permanent and reliable export of the Seychelles has been that of coconut products. The nut, after drying, is still placed in similar old mills to those used fifty or more years ago, and worked by cattle, donkeys, or ponies. The oil extracted is either used or exported as such, or made into soap, the carbonate of soda for which may be made (and is commonly made in the outlying islands for local purposes) by burning the husks of the nuts. A few coconuts are also exported, and in the last few years a certain amount of the dry kernel of the nuts, copra, has been sent to Europe. Many of the flats, rich in lime, have been placed into coconuts, and they are the chief product of the dependencies of the Seychelles. On some of the granite hills, up to 800 feet, they grow well, especially where not too far from the sea; their average yield, though, while thoroughly profitable, would scarcely seem to be more than a quarter of that on coral islands. The value of coconut products exported in 1905 was about £28,000, but this amount might easily be increased at least threefold by increased and better cultivation.*

Of other agricultural products of the group it is not necessary to say much. If Para rubber is developed successfully, their future will depend upon how far they can be grown under its trees, or on slopes unsuitable to it, or for the employment of labour during slack seasons. Cocoa grows well in the mountains, and at one time promised to be very successful. It was nearly dropped for vanilla, but will probably be revived with improved methods of cultivation. Liberian coffee yields bountifully, but gives no profit; its use is largely prevented by the fact that its beans require seasoning for at least a year before being roasted. Clove trees produce a good crop about every fifth year, and grow well. Pepper is only grown for home consumption, as also are tobacco and small quantities of various other spices. Sugar-cane is only planted by the natives, principally for the purpose of producing an intoxicating beer, known as "bacca."† All kinds of bananas yield well, and may

* A conservative estimate shows that at least 13 per cent. of the oil is not extracted by the primitive mills employed. The ground under the trees is dirty, and the trees themselves are planted too close for the best total yield per acre. Many of the trees are much bored by beetles, but this can easily be cured by cleaner cultivation and by preventing the natives from cutting the trees with the large knife, like a machete, which is commonly carried. The nut grown is a small variety, and might be profitably replaced by the Ceylon nut. Lastly, the area might be greatly increased in the Seychelles, and more than doubled in its dependencies.

† The collection of "kalou" (coconut sap), and the fermenting of the same, is prohibited. Owing to the present depression, "bacca," much to the detriment of the revenue, has largely replaced the strong red Provence wine and the Mauritian rum that used to be drunk by the natives. The regulation of its fermentation is one of the chief troubles of the police.

subsequently be developed for banana flour, or preservation for cooking purposes. The export of pineapples to Egypt, etc., is suggested, and of other new products possibly valuable in the future we may mention cardamoms, camphor, sandal-wood, and mangrove bark. Fibre has been tried, and proved unremunerative.

Among natural products of such an island colony we may mention guano, the export of which may be increased in the immediate future, though it must ultimately cease. Tortoise (*i.e.* turtle) shell is important, but keeps up solely because it is only in the last few years that serious attempts have been made to commence the development of the southern dependencies of the colony. If the present ruthless destruction of these

A TYPICAL MILL OF THE BEST CLASS USED FOR EXPRESSING COCONUT OIL. COCONUT MILL ON THE ILE DU COIN.

turtles is continued the supply will cease, but probably the young could be penned off and profitably grown in many of the atoll lagoons. The latter, too, are in many cases studded with shell-oysters, the cultivation of which, as well as that of sponges, is only a matter of time. Lastly, we may refer to the export of calipee, the gelatinous shell of the edible turtle, and to that of dried fish, the latter capable of some development, though wholesale methods, such as by trawling and drift nets, are not likely to be successful.

Examined in respect to the natural sciences, the Seychelles group must always be regarded as possessing extraordinary interest. Granite is essentially a continental rock, and its islands form the most isolated masses of such rock in the whole world. Its fauna and flora are of

immense importance to the students of evolution and of geographical distribution. To the pure geologist, who attempts to trace the topographical history of the world in past ages, it must be considered as a possible link between Africa, or Madagascar, and India; while to the oceanographer, who is concerned with the ever-continued fight between land and sea, it presents innumerable problems. To the historian's mind it must bring an entrancing tale of daring struggle; while for the anthropologist it almost appears to be developing in its "enfants des îles" a new race of mankind with a peculiar tongue, the Creole, on a French basis with Indian, negro, and English words. Its beauty caused it to be termed by General Gordon the "Garden of Eden," while its healthiness must ultimately make it a sanatorium for neighbouring continents. Like all island groups, its economic condition fluctuates, and it is at present depressed, but even now there are signs that its curve may rise higher than before. To us, as a seafaring race, an island group, developing a hardy race of sailors, may at any time be a possession of inestimable value, and strategically Port Victoria is an excellent harbour, the possession of which is obviously of enormous importance to the whole empire.

In conclusion, we would desire to express our indebtedness to his Excellency the Governor of the Seychelles, W. E. Davidson, Esq., for his keen interest in all that affected our scientific investigations, and for much personal kindness—his reports for 1904 and 1905 will repay investigation, and have been used by us without specific acknowledgment; to Mr. H. P. Thomasset, a most accomplished naturalist and the chief English planter in the Seychelles, for his continual aid in many ways; to Mr. R. Dupont, the vigorous director of the Botanic or Economic Station, who freely showed us his numerous experiments, and who gave us most valuable information on the geology and botany of the group; to M. de Gaye, M. Bouton, Mr. Connor, Mr. Griffiths, and a host of others whose suggestions and advice were often of the greatest value. These gentlemen, it is needless to say, neither individually nor collectively, are responsible for any opinions expressed in this paper.

Before the paper, the PRESIDENT: I do not think that I need occupy your time to-night by any introductory remarks, because Mr. Stanley Gardiner, who is the lecturer of the evening, appeared before us so lately as last June, when I had the pleasure of giving a sort of summary of his geographical career; and the paper which he read us in June on the Indian ocean, of which this present paper is practically a continuation, appears in the current number of the *Geographical Journal*. I think I had better, therefore, just call upon him at once to read his paper.

After the paper, the PRESIDENT: We have here to-night among those present Lord Stanmore, who, I believe, for years was Governor of the Mauritius and Seychelles, and if he would say a few words we should be very much obliged to him.

Lord STANMORE: It is more than thirty years since I last saw the Seychelles, and

therefore I am afraid I cannot add anything very novel or give any of the latest information to supplement my friend Mr. Stanley Gardiner's lecture. What I can say with great truth is, that I, I believe in common with all of you, have listened with very great interest to what he has said, and have admired greatly what he has shown us. Some of those photographs have brought back to me scenes which I have not seen, as I have said, for a very long time, but of which I retain a very vivid memory, and recall to me some of the pleasantest days of my past life. It was always a great relief to me to go up from Mauritius to Seychelles, and, in the charming scenery and lovely climate of that group, to refresh one's self from the fatigues which are incident to a life in Mauritius. But much pleasure as I felt in listening to Mr. Stanley Gardiner, I cannot deny but that he caused me some pain and regret, for I perceived, from the absence of any representation of them in his photographs, that the fine forests which existed in Seychelles some thirty-five years ago appear to exist no longer. With the exception of a large dead tree, we saw nothing in the photographs of anything like forest; what we did see was a great expanse of bush, and I am sorry that this is the case, because it is a great misfortune to the Seychelles, and it will ultimately, no doubt, affect the climate and many other things there. Then, again, with regard to the vegetation, he explained to us how it had been destroyed; it was not the result of forest fires, but arose from causes of decay of which he told us. Now, there again is a great change since the days I remember. In Mauritius one used to see, in the forests there, great gaunt stems of trees standing up everywhere amongst the greener foliage, and the contrast which was presented to one from seeing nothing of the sort was a great relief. Now, I am afraid, Seychelles seems to be much in the same way as Mauritius in that respect. Those are great changes. Mr. Gardiner also told us—and that I also heard with regret—that he inclined to the opinion that the vanilla industry, which was only starting in my days, has proved to be not a success, and that he fears it ought to be given up. That, too, is a thing to be lamented. But I have really nothing to tell you or to teach you; I have merely come up here to thank Mr. Gardiner in your name, as well as my own, for the pleasure which he has given us, and to say that it is to me a very great pleasure indeed, because Seychelles is a little-known place, and one does not often hear much about it. It was my fortune to be connected more with its political history than anything else, but still, during my stay there, I always gave a large portion of my time to the natural history, to the fauna and flora of the country, which Mr. Gardiner has told you—but I think, perhaps, he has hardly dwelt strongly enough upon the fact—is in many ways quite distinct from that of any other place. I am afraid some of those species have since been exterminated, but the number of birds and of plants that were found nowhere else was, five and thirty years ago, quite remarkable.

The PRESIDENT: As we are dealing with governors of the Seychelles, I will call upon a gentleman of the Colonial Office upon whom the administration largely falls—Mr. Bertram Cox.

Mr. BERTRAM COX: Among the many interesting pictures which Mr. Stanley Gardiner has been kind enough to show us this evening there was one which more than another particularly appealed to me. It was one which represented a mill, with a negro sitting beside it, a large pole coming out from the mill, and six animals of an asinine character engaged in driving that mill round. If you take the mill as representing the colonies, and the gentleman who sat beside it as the native inhabitants, I think you may take the animals who were driving that pole round as representing the office I have the honour to serve. They have their uses, and their business is to keep these particular mills and these particular colonies grinding as

far as they can, and turning out the good work of which our colonial officials are so eminently capable. To the Colonial Office all colonies are equally distant and all colonies are equally important. Political officials who serve in such out-of-the-way places as Seychelles often consider that they are in a backwater, and are neglected and are unknown; but that really is not the case, because in the colonial service in this country we live from mail to mail; we are a great correspondence department, we get dispatches in by all mails, we have to answer them, and in the mean time to find out what we can do to carry out the wishes of the colonies and those improvements which are so essential to make them prosperous. Now, in the Seychelles we suffer from a great difficulty, and that is communication. As Mr. Stanley Gardiner has told us, Seychelles would form an admirable sanatorium for East Africa, and also for other parts of the world, but the difficulty is the mail service; a mail service cannot be got without a subsidy, and a subsidy cannot be got without a contribution from Seychelles, which is rather more than Seychelles can afford to give. It is true the Imperial Government does give a certain contribution for the mail service, but that contribution is not sufficient to give Seychelles the continuous and regular service which it ought to have, and which I hope some day it may get. But at present that is the main difficulty standing in the way of Seychelles becoming anything like a sanatorium for East Africa. With regard to vanilla, it is perfectly true that the vanilla crop has not been of late years what one hoped it might be, and Seychelles has been in great danger, I grieve to say, through not having any staple commodity to fall back upon, though for many years the Colonial Office has been urging on the various governors the necessity of endeavouring to do all they could to get some other product which would take the place of vanilla, and give the planters and the people something to fall back upon when the vanilla failed, as it was felt that vanilla must fail. That has been done to a great extent, first in the case of coconuts, and, secondly, in other productions, such as coffee, which my friend, Prof. Dunstan, thinks is not so likely to succeed as copra. Mr. Sweet-Escott, the late governor, founded a botanical station, in which plants and grain have been cultivated, and where some of the inhabitants have been trained to take an interest in these productions. This garden has been made an object lesson for the planters, in order that they may find new productions to take the place of vanilla. I think in that way Seychelles will very probably tide over its difficulties. This present time is a critical one. The vanilla has failed; it has been competed with by this terrible vanillin, which I was told was made of turpentine, but which I afterwards found came from oil of cloves; and the natural crop has been disappointing. We can only hope that the other products which have been introduced, and the excellent system of roads which Mr. Escott opened up, may lead to that greater prosperity of Seychelles which it will always be the interest of every Secretary of State for the Colonies to promote as far as in him lies.

The PRESIDENT: I will now ask Mr. Henniker Heaton, M.P., if he will say a few words. He knew the Seychelles very well.

Mr. HENNIKER HEATON, M.P.: The reason I have been selected to speak about Seychelles is probably because I have visited it about a dozen times. It is a matter of wonder to me that the Royal Geographical Society, which has done so much in past years in sending out explorers and navigators, has not fitted out a great expedition and chartered a great steamer to carry ladies and gentlemen of the Royal Geographical Society to those beautiful parts of the Earth they were the means of discovering in past years. This expedition that I suggest to the Royal Geographical Society might extend its journey to other islands in the South Seas, known to Lord Stanmore, over which he ruled for many years, and it would give great delight to visitors in search of health and rest, and it would have a great

educational influence. In regard to the Seychelles themselves, they are indeed a glorious possession; every bit of soil, if cultivated, I am sure would, if tickled with a hoe, smile with a harvest. It is a wonderful place, but suffers from its being on the road to Nowhere! That is one of the reasons why it does not flourish. It is a most delightful island in a most glorious spot, and I do not differ from the man whose memory is very dear to us, General Gordon, in his view that the Seychelles was the original Garden of Eden.

The PRESIDENT: Would Prof. Wyndham Dunstan say a few words?

Prof. WYNDHAM DUNSTAN: I should like to add my testimony to the expression that has already been given with reference to the great interest of Mr. Stanley Gardiner's paper. My only regret has been that he said so little about a subject on which he is so well qualified to speak, namely, the fauna of the islands. Lord Stanmore alluded to the interest he took in the birds of the island when he was governor; but we did not see a single bird in any of the photographs, and I am sorry Mr. Gardiner said nothing in his paper about the birds or the animals. Perhaps he has reserved that for a special paper to be delivered elsewhere. It is extraordinary how little is known about the Seychelles in this country. There are a number of people who are interested in turtle soup, and who enjoy eating it, but there are very few who are aware of what Mr. Henniker Heaton has reminded us, that one of the most esteemed forms of that delicacy comes from the Seychelles, as is well known to certain cooks in the city of London. These islands have a most excellent climate, are well adapted for European settlement, and, in my view, they have great commercial prospects; but they suffer from two difficulties at the present time—one is the defective transport, to which Mr. Bertram Cox has alluded, and the other is the absence of British capital, and of information here as to what the resources precisely are. The present governor, who always strikes me as one of the most enlightened of colonial administrators, is taking a very great interest in the industrial development of the territory over which he rules. He realizes that upon the commercial development of the Seychelles depends the possibilities of good government and sound administration, and in recent years he has had an extremely difficult time owing to a diminishing revenue. Now, this diminution is chiefly due to what I regard as an economic mistake. It is the mistake of putting all your eggs into one basket. The planters of Seychelles have depended for many years upon one crop, and virtually only one crop, namely, vanilla. Mr. Gardiner has told you something about vanilla. I am by no means pessimistic about vanilla if it is cultivated in Seychelles in conjunction with other crops, but we may be perfectly certain that it can no longer be regarded as the staple industry of the colony. That is principally due to a situation about which I desire to remove some misapprehension. We have been told by Mr. Gardiner that it is due to the competition with vanilla of a "chemical substitute." I wish to explain that this is not a chemical "substitute" in the strict sense of the word, but it is a plant product reformed by chemical means. What chemistry has done is not to produce a substitute for vanilla, but to produce the very substance to which the plant chiefly owes its aromatic value. It is a question of producing, not from turpentine or coal-tar, but from oil of cloves, a material (vanillin) which is identical with that found in the plant. If this fact is realized, I think one sees at once that the doom of vanilla as a staple industry is certain; the material is produced more cheaply by chemical means than by what one may call vegetable means. Mr. Gardiner alluded to another cause for the falling off in the revenue from vanilla, a purely secondary cause, a defect which I believe can be remedied—that is the inferior quality of vanilla as compared with that produced in some other countries. That is a matter of better selection and cultivation; in fact, there are signs already

that when some attention to this matter has been given, the vanilla in Seychelles will be very much improved. No doubt it will be able to hold a place as a subsidiary industry in the colony, as by some the use of vanilla is preferred to that of synthetic vanillin.

I have taken a very great interest in the commercial development of the resources of the Seychelles through the applications of science. I have acted, in fact, as the humble instrument of the Colonial Office, through which the government of the Seychelles is controlled. I am unable to state what animal I may represent in Mr. Bertram Cox's parable; none was small enough to be seen in the picture. I should like to allude to one or two matters which seem to me to present considerable possibilities from the commercial side. You have heard a great deal about coconuts. There is no doubt that the production of copra, of which Mr. Gardiner has given you an account, will be an important matter. Further, the production of oil from it, I agree with him, might be conducted with less primitive methods. I do not think he mentioned that at the present time soap is being actually produced in the Seychelles from coconut oil. I believe that is likely to be a profitable industry, although the soap, you may regret to know, is not likely to come to this country, but goes principally to East Africa. Then there is another matter in which I have taken some interest. The banana of Seychelles differs in some respects from the banana of Jamaica, and produces, when dried and powdered, an orange-coloured flour suitable for certain food materials which are being manufactured in this country. I have been the means of bringing under the notice of some English manufacturers the peculiarities of this banana flour, and I am glad to tell you that at the present time machinery is being employed in the Seychelles for the desiccation of the banana and the production of the flour, which seems likely to be largely consumed in this country. Another matter of more importance is the guano of the Seychelles, and the phosphatic rock formed from it which has recently been brought to light. That rock appears to have been formed by the washing through from the guano of phosphate of ammonia. This has produced from the underlying coral what is virtually a phosphate of calcium, which is largely used as a manure for agricultural purposes, and the shipment of which is a very profitable industry in Florida and elsewhere. This can only be a temporary industry. The growing of plants which give essential oils and perfumes, lemon-grass, and others appears to be easy in the Seychelles, and I believe that an oil-distilling industry may be successful. But far more important than these is the question of growing rubber. I must not take up your time by any lengthy discussion of the rubber problem in connection with Seychelles. There has been a very large increase in the past few years of rubber-planting all over the world, and most of us who have looked closely into the question know that the demand is likely for some time to exceed the supply, and therefore it is certainly worth while considering the question of rubber-planting in the Seychelles. Mr. Stanley Gardiner has told you that to some extent it has been ascertained by actual trial that the tree which furnishes Para rubber grows very well in the island, but, unfortunately, it is not safe to conclude that on this account alone a rubber-producing industry will be certain success. I think myself it is very probable that it will be found that these trees will produce good rubber, but, so far as I am aware, that has not been actually proved, because it is not possible to tell, until a tree is between six and seven years old, whether it will furnish good rubber or not. A rubber tree may flourish, as it does in certain parts of India, but nevertheless produce very poor rubber, and, so far as I am aware, the trees in Seychelles are at present only between three and four years old.

One of the most important means through which the industrial development of

the Seychelles will be promoted is through the station which Mr. Bertram Cox has mentioned, the Botanic Station, which is now under the direction of Mr. Dupont. It has already done excellent work in the sense of providing object-lessons for the planters of the growth of economic trees and plants that might be introduced into the islands. In my view, the most pressing need in the Seychelles is for the better endowment and extension of that station; in fact, for its conversion into an agricultural experiment station. I believe no more important step could be taken for the prosperity of the Seychelles than the development and extension of the present small department, so that systematic trials can be made in the cultivation of all kinds of plants and crops, and information given to the residents in these matters.

The President: We have here to-night the son of the enlightened governor to whom Prof. Dunstan has referred, and perhaps if he will say a few words on Seychelles up to date, we shall be very much obliged to him.

Mr. Davidson: I came here to-night with no expectation of being in any way called upon to speak, and indeed my only claim to speak is that I returned only a month ago from the Seychelles. Mr. Gardiner has told you far better than I can of the beauty and of the capacity of the islands; and Prof. Wyndham Dunstan has most ably detailed the experiments that are being tried to rescue the islands from the trough of the wave into which they have at present fallen. It is perhaps interesting to state that shortly before I left I saw some rubber trees which had been tapped. I think they were between six and seven years old, and the rubber was pronounced by Mr. Dupont, the head of the Botanic Station, to be of really good quality. Certainly all the suggestions which Prof. Wyndham Dunstan made would materially contribute to the prosperity of the island, but, unfortunately, all these experiments require considerable expenditure of money. The island at present is barely paying its own way, and must continue for some years to be in a state of poverty; consequently it cannot have its resources developed to the fullest extent, except by the introduction of outside capital, either in such enterprises as the desiccation of coconuts—for which a Belgian company has been formed recently—or in the removal of phosphatic rock, which is likely to be of considerable pecuniary profit to the islands, even though they may lose somewhat in superficial area.

The President: I will now ask you to give a vote of thanks to Mr. Stanley Gardiner for his most delightful paper, and I will at once make way for him to reply.

Dr. Arthur Haydon: Mr. Stanley Gardiner made some reference to the possibility of a sanatorium being placed on a plateau in Mahé island. He also mentioned the fact that there was an entire absence of all fevers on the island. What I would like to know is, did he include in that the well-known jungle fever which is so prevalent in India? and if the place is so extremely healthy, and a sanatorium could be erected in the most suitable place on one of the islands, perhaps the supply would create the demand, and possibly a steamship service from the neighbouring mainland once in three months, bringing over a certain number of invalids, might contribute towards the prosperity of the islands.

Mr. J. Stanley Gardiner: I would desire, in the first place, to express my gratitude to you for the patient way in which you have listened to me to-night; and I would also thank the various speakers for the kind tone of their remarks. I may perhaps reply to Dr. Haydon first. So far as I am informed, there is no jungle fever, and, looking at the conditions of the islands, I cannot see that it could, even if introduced, get any hold. I was particularly interested in Lord Stanmore's remarks on the forests in the Seychelles, when it was a dependency of Mauritius, of which he was governor. I regret that the visitor now, after the lapse of thirty years, can see none of the jungle as he understood it. All the high trees have been cut down, or killed out by the beetle to which I have referred. The indigenous

birds are becoming extinct; in fact, most species are extinct. There is a law for the protection of birds. This is as it should be, but this law was copied from the law in Mauritius, and it presents the curious anomaly of protecting in the Seychelles archipelago the birds of Mauritius, scarce one of which is actually found there.

I fear that I cannot entirely agree with all the remarks of Mr. Bertram Cox and Prof. Dunstan. In the first place, the gardens were not established as an economic station; they were mainly botanic gardens, and were planted partly for beauty and partly for the amusement of the people of Port Victoria. They are situated close to the coast, whereas the greater part of the planting land is up at from 600 to 1200 feet. I cannot say that in my opinion they had done, or attempted to do, much for the planters up to a couple of years ago, though I willingly bear testimony to the very admirable work they are doing now. With regard to communications, to which Mr. Henniker Heaton, I think, also referred, it is to be regretted that the only regular service is by a French line, the Messageries Maritimes, whose heavy charges for freight are a severe handicap on the planters. With Prof. Dunstan, in his remarks on vanilla, I very largely agree; but I do not attribute its fall in price mainly to the discovery that vanilla can be isolated from oil of cloves, but to competition with other countries. I do not believe that there will be any improvement in its cultivation, or in methods of cultivation in general, until there is individual ownership of property. I do not believe in enterprises in tropical countries, when the land is divided up, on the death of the owner, among his children. I think, when in a few years' time the agreement, under which the law of the country is the Code Napoleon, comes to an end, and when presumably the law will be the law of England, that development is likely to take place with respect to planting. Prof. Dunstan did not refer to another development of the banana, *i.e.* its drying. Experiments were being made, and an article was being produced, samples of which I brought home. Even after six months the dried bananas made excellent sweets or futters, and it may be that they may become ultimately as popular as the dried apple. Bananas can, roughly speaking, be produced at one hundred per quarter of a rupee, so that any good method of drying is likely to be of considerable commercial value.

NINE YEARS' SURVEY AND EXPLORATION IN NORTHERN AND CENTRAL CHINA.*

By Lieut.-Colonel A. W. S. WINGATE.

THE title of the paper which it is my privilege to read before the Fellows of this Society must appear somewhat ambitious. I need hardly remind any one that it would be beyond my powers to traverse, in the limited space at my disposal, the vast extent of territory covered by the many British explorers who have travelled in Northern and Central China during the nine years that I have been connected with the Far East.

In the words of the Rev. Arthur Smith, "China is a vast empire, proverbially difficult to understand, no matter what the length of time may be which has been spent in it; therefore it is important to be on one's guard against those cheap and easy solutions of a difficult and

* Read at the Royal Geographical Society, December 17, 1907. Map in the next number of the *Journal*.

complex problem, which, by misrepresenting some of the factors, omitting others, and remaining in total ignorance of yet more, may be able satisfactorily to explain everything about China in a few succinct and well-turned paragraphs."

Since first I landed in Shanghai in September, 1897, many world-stirring events have occurred, and did space and my profession permit, I

would have liked to dwell, in spite of Arthur Smith's wise warning, upon some of the great changes which have so altered the map of the Far East, and have transferred the hub of the diplomatic wheel from Constantinople to Peking. In the preface to what is, I believe, the only handbook of geography of the Chinese Empire, which was published last year, the learned editor, Père L. Richard, says:—

"While engaged on this work, it has been more and more brought home to me that the day has not yet arrived for the publication of

a strictly scientific geography of China. Although for certain districts and provinces there may be no lack of authoritative information, for others there are only conflicting statements, or else complete ignorance.

"There are, for instance, differences of altitude, ranging from 3000 to 5000 metres in well-known localities, and this, too, in scientific works by authors renowned for their accuracy. We will not speak of the populations of provinces and towns, the wealth of the country, the navigability of the rivers, the climate. Then what of the position of the towns? With the exception of the map of Chih-li,* in course of preparation" (possibly a reference to a Chinese edition of the Survey of India map.—A. W.), "all accurate mapping remains to be done, and little progress has been made in this direction during the last three centuries. In political and economical geography, there have been so many changes during the last few years that it is next to impossible to keep abreast of them.

"It is a *new* China which is arising on the ashes of the old, and it would be difficult to predict what the awakening will be like in the course of a decade or two. We may be spectators of a transformation as complete as that of Japan, but of a slower and more rational growth."

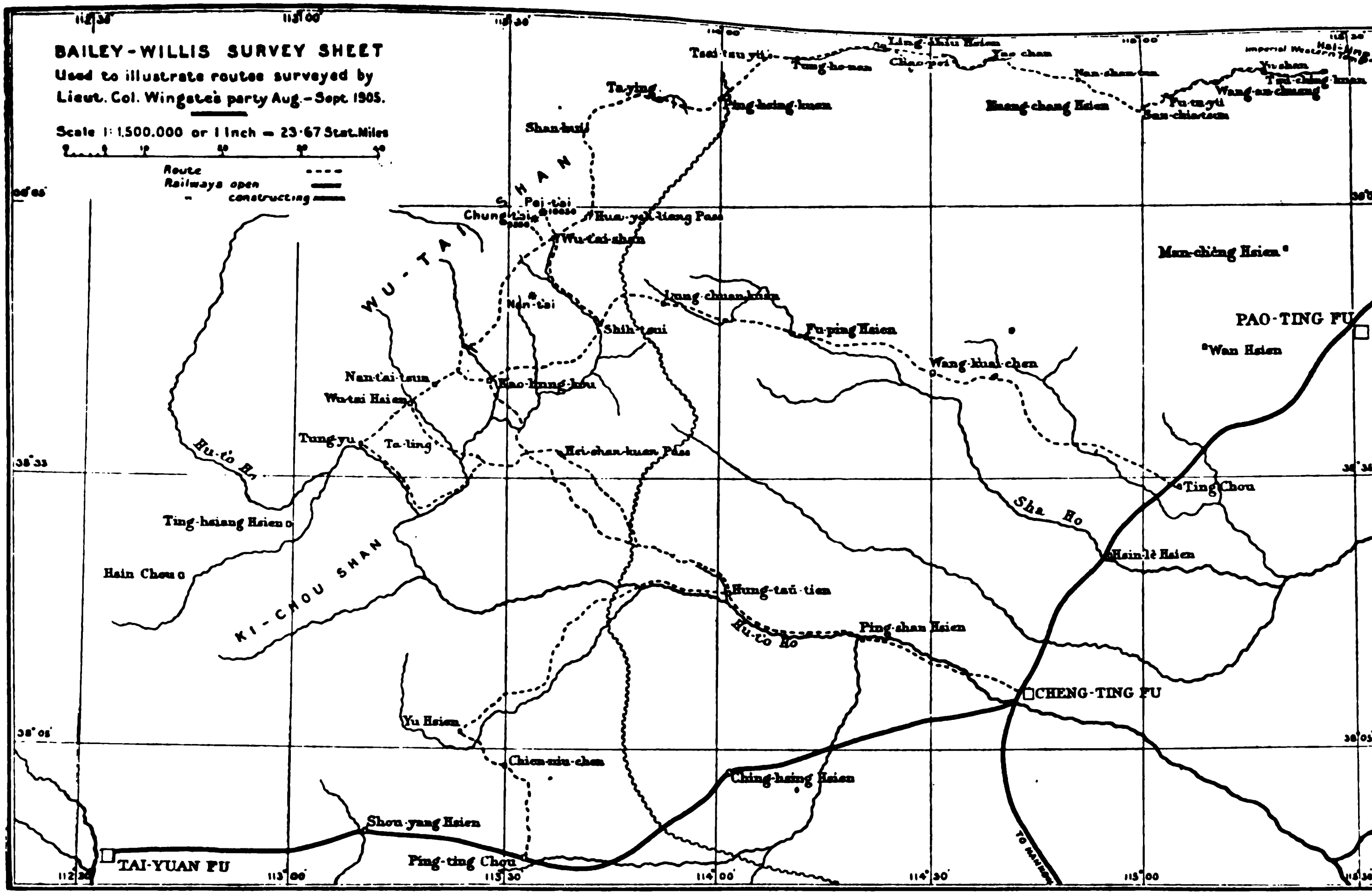
Commercial geography and the geography of railways must also, for the next generation or two, be given a prominent place in speaking about China; for, though the Chinese are before everything else farmers, they are none the less, one and all, in their spare moments travellers, and buyers and sellers of goods.

I propose, in the first instance, to review very briefly the geographical work in Northern China with which I have been more or less personally associated, in order to illustrate the changes which our maps have undergone, and are still undergoing, and to give an idea of the large amount of exploration and survey work that has been quietly accomplished in those regions by British subjects during the last half-dozen years.

Subsequently, I will relate some of my experiences during recent travels, last year and this, in the eastern part of Central China, in company with Captain F. G. Turner, Royal Engineers. I take this opportunity to remark on the energetic and persevering manner in which this officer, with the assistance of only a couple of Indian military surveyors (not Survey of India men, be it noted), produced under adverse circumstances excellent surveys, portions of which are given in the maps which accompany this paper.

The region over which our explorations extend is shown in the inset map. Of this region only three areas have been properly triangulated and surveyed by British surveyors; they are Inner Chih-li, a portion of Northern Ho-nan, and the Wei-hai-wei territory. The

* The system of orthography here adopted is Sir Thomas Wade's, except for well-known places, such as Peking, Shanghai, Hankow, etc. The term "Péchili," so common on existing maps, is never used in China, and has no real justification.


BAILEY-WILLIS SURVEY SHEET
Used to illustrate routes surveyed by
Lieut. Col. Wingate's party Aug.–Sept. 1905.
Scale 1:1,500,000 or 1 Inch = 23·67 Stat. Miles
Route
Railways open
constructing
WU-TAI SHAN
KI-CHOU SHAN
PAO-TING FU
Wan Hsien
Man-chêng Hsien
TING CHOU
Hsin-lê Hsien
CHENG-TING FU
TAI-YUAN FU
Shou-yang Hsien
Ping-ting Chou
Ching-hsing Hsien
Chien-miu-chen
Yu Hsien
Ping-shan Hsien
Hung-tai-tien
Hu-to Ho
Sha Ho
Wang-kuai-chen
Fu-ping Hsien
Lung-chuan-kuan
Shih-tsui
Hao-kung-kou
Nan-tai-tsun
Wutai Hsien
Tung-yu
Ta-ling
Ting-hsiang Hsien
Hsin Chou
Nan-tai
Wu-tai-shan
Hua-yeh-liang Pass
Hsi-shan-kuan Pass
Chung-tai
Pei-tai
Shan-hui
Ta-ying
Ping-hsing-kuan
Tsai-tsu-yü
Tung-ho-nan
Ling-chiu Hsien
Chiao-pei
Yao chan
Nan-chen-tan
Kuang-chang Hsien
Fu-tu-yü
San-chia-tsun
Wang-an-chuang
Yü-shan
Imperial Western Tombs
TO HANKOW
113°00
113°30
114°00
114°30
115°00
115°30
112°30
38°35
38°05

balance of the survey work done is in the main confined to plane-table traverses of routes and plans of cities and localities. That more should not have been accomplished, with the limited means at disposal, is not remarkable if we consider the area over which our geographical explorations have extended, and that we have been working under somewhat unfavourable conditions.

Many observations for latitude have been taken, but not one for longitude. We were not equipped for this. We have relied on longitudes fixed by the navy when available; otherwise we have accepted those given on Bretschneider's map. With some notable exceptions the Jesuit Fathers did this part of their work admirably, and it is for this reason that small-scale maps of China are in the main accurate in respect of latitude and longitude. It is in the details of hydrography and relief of the land that they fall so far short of the modern maps of other countries.

In these matters, until after 1900, the greater part of China was almost as unmapped as Central Africa used to be.

For the results obtained, thanks are due to individual explorers, and to companies, such as the Peking Syndicate and the British and China Corporation. Except indirectly, and by the loan of instruments, I do not think the Royal Geographical Society has contributed towards the expenses of China exploration—at any rate, in the region with which I am now concerned.

Prior to 1900, foreign (by which is meant anything not Chinese) maps of China were extremely defective. The best were those of Bretschneider (1 : 4,600,000), Waeber (1 : 4,355,000), and Richthofen (1 : 750,000), based almost entirely on Chinese maps—produced in the reign of the great emperor K'ang-hsi (1708–18), under the direction of the Jesuit Fathers—with the assistance of British Admiralty charts. Now, Chinese maps are better than none at all; indeed, sometimes, in in the hands of those who understand them, they are very useful; but, although the more recent ones show a great improvement, they are not what we are accustomed to call maps nowadays. As in so many other instances, the Chinese Government, having made a splendid start, seemed satisfied to let things be. We are sometimes advised to "let sleeping dogs lie;" the Chinese do not require urging in this respect—in geographical matters, at any rate! Hitherto they appear to have acted up to both the letter and the spirit of this ancient maxim. Consequently, though the distinguished men above mentioned accomplished wonders with the scanty and often inaccurate material at their disposal, their maps are sometimes misleading on important points. Two maps based on those above mentioned, which have had a wide circulation and served a useful purpose, are the China Inland Mission 50-miles-to-the-inch map, and the one-to-a-million German map. Compare, for instance, the courses of the Hsi Liao Ho, Lao Ho, Pei Ho, or Huang Ho, as depicted on any of those maps, with their courses as shown in the sheets of the most

recent maps issued, or shortly to be issued, by the Topographical Section of our War Office. However, as the triangulation of Japan was only completed in 1880, we must not expect too much of the Chinese maps.

Inner Mongolia or Outer Chih-Li Province.

Six years ago the large tract known as Inner Mongolia was practically unmapped and very inadequately explored. To the average foreigner, and to most Chinese, it was generally supposed to be a wild, robber-infested, unproductive country inhabited by nomad Mongols. Yet it was through the heart of this region that a Manchu army found its way to the Chih-li plain when the main army was successfully

VIEW FROM PAI-HUA SHAN (7000 FEET) ON THE MORNING OF MAY 20, 1905.

blocked by the Chinese at Shan-hai-Kuan, where the Great Wall enters the sea. Again it was at Je-ho (the name signifies "Hot Stream," and is commonly called Jehol) that our ambassador, Lord Macartney, was royally entertained by the Emperor Ch'ien-lung in 1793. Huc, writing in 1844, says it is twenty years since any Emperor hunted there. No Emperor has visited Je-ho since Hsien Feng died there in August, 1861 A.D.

The palace and grounds, which have a circumference of 16 miles, are still there (1904), though the former is in a dilapidated condition. The last royal visitor was the present Dowager Empress in 1860. Staunton has left an interesting and, so far as relates to geography, an accurate record of Lord Macartney's journey to Je-ho and neighbourhood. He says, "The town of Jhe-hol, excepting the houses of the mandarines,

consisted of miserable hovels full of people. The streets were crowded, crooked, unpaved, and dirty." This description is as true to-day as when written over one hundred years ago. He also gives a plate and description of a remarkable natural column of conglomerate (some of the stones in it are over a foot in diameter), which is a conspicuous feature in the landscape, visible from several miles distant. This column is still there. Staunton's description and the drawing of it are in the main accurate.

How many hundreds or thousands of years, I wonder, since it formed the core of the mountain on which it stands, and its top the mountain summit? When will it topple over? It is more than 180 feet in height, measured from its base on the rock which forms its pedestal; on the top are some flat rocks and bushes which serve as some protection against the effects of water and wind, thus giving it a peculiar carrot-shape appearance. Its height and bulk may be judged by comparing it with the figure of a man standing in the niche at its base, shown in the photograph taken by me in 1904. It has apparently undergone no change during the hundred years or so since Staunton's engraving was made. There are several other similar formations in the district—all silent witnesses of the geological age of these mountains, and of the effect of water action on the softer, surrounding materials, which have been carried away to help in making the Chih-li plain. I am not a geologist, and therefore cannot explain what seemed to me a curious fact—namely, that all the columns which I saw (three of which I photographed) appeared to be of equal height. While on this subject, I may add that Staunton's plate shows a good-sized cargo-boat in a position where now it could not well be, owing to lack of sufficient water. At Je-ho there is a potala, after the style of the one in Lhasa, but, of course, on a much smaller scale. In outward appearance it remains as of old, but inside much destruction has taken place, one large chamber being a mass of ruins, the roof having fallen in, burying in the *débris* many valuable works of art.

It may be of interest to note here the influence which the great potala of Lhasa has had upon the architectural design of its namesake at Je-ho. This is well illustrated in the photograph, taken by me at Je-ho in 1904. The glory of the first has survived, but the sun of the latter is now well set. Since emperors have ceased to interest themselves in any of these once beautiful temples, funds have been insufficient to maintain them in their pristine magnificence. Though, sad to relate, many of the precious works of art which they contained have disappeared, there are a few of extreme interest remaining. At Je-ho, among others, is the jewelled sword of the Emperor K'ang-hsi, and a very fine solid silver elephant of Indian or Siamese workmanship, doubtless a present in the days when Nepal and Siam were tributary states.

I do not think I can add much of importance or interest to the numerous accounts of the sights of Je-ho; one of the most recent is

that of Mr. Claude Russell in the number of the Royal Geographical Society's *Journal* for May, 1904. But in 1904, in place of the 800 lamas, which Staunton tells us were in the potala in his day, there were barely a hundred, while the number of mandarins and troops had dwindled from 100,000 and 80,000 to about 1200 and 800 respectively. These facts speak volumes for themselves; they represent with truth the state of affairs regarding two of the most important things for the future welfare of the Chinese—religion and defence. Both have been allowed to decay throughout the length and breadth of the Celestial Empire. Whenever one visits some famous place or building, the thought that springs uppermost in the mind is "Sic transit gloria mundi."

CONGLOMERATE COLUMN AT JE-HO (TAKEN OCTOBER, 1904).

Inner Mongolia, then, is a more or less mountainous region lying outside the Great Wall, between it and the real Mongolian grasslands which commence about lat. 42°, and would now be more appropriately called Outer Chih-li. Its mountains are rich in minerals, which have only been partially exploited; much might be done by the introduction of modern methods and machinery.

The ubiquitous Chinese have long since either ousted or absorbed the docile and more ignorant Mongols, and have introduced Chinese administration and methods. This procedure still goes on in yearly increasing force. It will not be more than a few generations until the Mongols will occupy a position in the empire similar to other early tribes, and will become lost among the Chinese colonists. Von Möllendorff called attention to this in the R.G.S. *Journal* of February, 1881, in which he stated that on political, ethnographical, and geographical grounds, the extra-mural parts should be regarded as a portion of China Proper. The time seems opportune for the relegation of ancient tribal names to the historical atlas.

Its administration, also, now differs hardly at all from Inner Chih-li, the chief difference being that Jeho is one of the last remaining districts over which the Tartar-General in reality has the principal control. Outer Chih-li has no governor. Nominally the viceroy controls both

Inner and Outer Chih-li. Very little has been published in the English language concerning it, though much valuable information will be found in Dr. O. Franke's learned work, 'Beschreibung de Jehol-gebietes in der Provinz Chih-li,' published in 1902. This distinguished traveller has borrowed rather freely from Chinese works dealing with that region, so that he has fallen into some of their mistakes, which have been repeated in the latest geographies and maps. Especially is this the case with respect to the Wei-ch'ang, or Imperial Hunting Ground, and the courses of the Hsi Liao Ho and Lan Ho.

The Wei-ch'ang lies between Jeho and the famous mart of Dolon-nor, or Lama Miao. This part of Outer Chih-li is full of geographical interest and historical associations. Its forest-clad hills and dense undergrowth afford a glimpse of what must once have been the general appearance of the whole of North China beyond the limits of the Great Plain. But the Chinese consume everything, and have so bared these northern hills as to leave scarcely a tree. They are paying dearly for their foolish shortsightedness. By acting thus they have probably altered the rainfall, which now descends in sudden heavy bursts, flowing quickly down the bare slopes, conveying with it much fertile soil, and often crops as well, besides causing floods and wholesale devastation in the lower reaches of the rivers of the Great Plain. In mitigation of the evil, however, is the fertilizing nature of this deposit once the floods have subsided. With a judicious system of afforestation, the region beyond the Wall would support a much larger population, and enjoy a mere equable climate.

Once—as Chinese maps bear evidence—the imperial hunting reserve extended far beyond its present limits. Dr. Franke gives it as 110 miles from east to west, and 70 from north to south, with a circumference of 450 miles; but the gradual advance of the Chinese immigrant has encroached upon this beautiful country to such an extent that it now covers an area of only 45 miles from east to west, and 55 miles from north to south, or, in round figures, 2500 square miles.

The present limits are from 116° 50′ to 117° 40′ E. long., and 41° 40′ to 42° 35′ N. lat. It forms a rough parallelogram, of which the four corners are—south-west, Kuan-Ti; south-east, Shih-pien-tzu; north-west, Yang-shu-pei; north-east, Hsia-po. It has now a circumference of only 230 miles, or 220 miles less than Dr. Franke's estimate.

Before many more years it is probable it will be completely thrown open to cultivation, as has been done in the case of similar reserves in Manchuria. Then good-bye to the last remaining bit of virgin forest in North China.

Thus, though many travellers have visited this region since the days of Marco Polo, Huc, and Gabet, when it formed the happy hunting-ground of Mongol and Manchu emperors, who sought in this bright, cool atmosphere relief from the dust and dirt of Peking, while chasing

the red deer through its wooded glens, it has been left to modern explorers, such as Doveton, Gunter, Woods, Russell, and others, thoroughly to examine and partly to survey it. Lieut. Doveton, in the summer of 1904, succeeded in penetrating further into this sportsman's paradise than any one.

He was prevented crossing from north to south, and again from west to east and east to west, not, as might reasonably be supposed, by the imperial forest rangers, but by a band of lawless robbers who regard this last reserve of forest and game as their especial preserve. Though a few shots were fired, rather by way of an exchange of cards than with any idea of conflict, Doveton and his party, bent only on geographical research, thought discretion the better part of valour, and on each occasion withdrew.

Concerning the Wei-ch'ang, Lieut. Doveton writes as follows: "It is, perhaps, the most interesting and least explored tract of country in Outer Chih-li province. So far as I am aware, no published description of it in the English language exists, though several of the early explorers penetrated as far as what is now the north-east corner. Gerbillon and Verbiest, at the end of the seventeenth century, describe the country near the sources of the Ying and Pai-ch'a rivers, and the latter mentions a mountain which he calls 'Petcha' (and speaks of as *un amas de plusieures montagnes*), covered throughout the year with snow, which, he suggests, may be due to its great height (9 Chinese li, or about 2¾ miles), and which he calls "large," giving a height of from 10,000 to 14,000 feet.

This mountain is, without doubt, Ta-kuang-ting-tzu, the highest point in the Wei-ch'ang, which can be distinctly seen from the plateau several miles away to the north-east. The probable reason why these early explorers did not penetrate further into this forest is because of its density and the very thick undergrowth, which even now is difficult to pass through, and in earlier days must have formed a complete barrier to man and animal transport. Most of the game used to be, and what is left of it still is, found near the base of Ta-kuang-ting tzu, north-east of the Lao-ling pass. The story goes that once when the Emperor Ch'ien-lung was riding after his quarry his pony stepped on a large flat rock, which is still to be seen, bearing the mark of his horse's hoof. There is no doubt there is such a mark, as my informant volunteered to show it to me."

Consequently, although since 1900 we have lifted the veil which hitherto surrounded, like that of the Forbidden City in Peking, this old-time imperial pleasure-ground, now the hiding-place for lawless people, yet there still remains this virgin spot of about 300 to 400 square miles, for some future venturesome spirit to explore and map.

Lieut. Doveton also visited Shang-tu or Cho Naiman Sume (108 temples), as the Mongols call it, the site of the ancient capital of the

Yuan Dynasty, and described by Dr. Bushell in a paper read before the R.G. Society in 1874. Mr. C. W. Campbell visited these ruins in 1902. The only additional information which Doveton has brought is a set of photographs showing the actual condition of the ruins just thirty years since Dr. Bushell's visit, and about six hundred since the Mongol Emperors lived there. Just outside the remains of what was once the city wall is a well which, on June 16, 1904, was coated with ice 4 to 6 inches thick and 6 to 7 feet below the surface of the ground.

Mr. Campbell remarks that if something is not done to preserve these relics of an ancient city, the capital of a fast-disappearing race, the Chinese settlers will soon demolish all that is left. One marvels that the Chinese, who are so fond of ancient things, do not take more interest in the preservation of their relics. Some day they will deeply regret having neglected to do so. Dr. Bushel states that, according to Chinese accounts, boats once ascended to Shang-tu. This may be so; in China it is as well to be careful in naming places where the Chinese will not take boats, but they certainly do not take them up the Lan Ho above lat. 41½° nowadays.

The inhabitants of Outer Chih-li differ hardly at all from those of Inner Chih-li, except that they are perhaps a little poorer and rougher, and pass under the generic term of "Mantzu" instead of "Hanjen." They suffer much from goitre. Staunton says that when he was at Jeho, the doctor calculated about one-sixth of the population had this complaint. Woods, Goold-Adams, Gunter, and others who have travelled in Outer Chih-li since 1900, also speak of the prevalence of this growth. Captain Gunter put the number of those afflicted at one-half the population of K'u-pei-K'ou.

In spite of Dr. Franke's book and Dr. S. W. Bushell's paper, much still remains to be written about Outer Chih-li, with its gold, silver, coal, and other mineral deposits, its mixed population, old-world ways, historical associations, and partly unexplored tracts; the subject is deserving of a paper to itself.

Regarding the flora and fauna, a very complete list is given in Appendix A of Dr. Franke's work. It is evidently a translation from the Chinese, and must refer to some remote epoch, as regards the fauna at least, for many of the species mentioned are no longer to be found in Outer Chih-li. Such, for instance, are the tiger, the bears, and several of the deer. Nowadays, practically the whole of the large game is confined to the eastern and western hunting-grounds, of which the former, or Wei-ch'ang, contains the greater number. There are still to be found the "Ma-lu," or red deer—a fine stag weighing about 600 lbs., and similar to that of the T'ien-shan mountains; the "Yang-lu," like a spotted deer in size and appearance; the "p'ao-tzu," the Asiatic roe-deer, with small antlered horns about 12 inches in length, weighing 60 lbs. or so. These latter are almost the only deer in the western

hunting-ground. The "huang-yang," or gazelle, is found in considerable numbers west of long. 117° and north of lat. 41°, as many as 600 being seen in herds at one time. There are also a few hog-deer ("chang") and perhaps half a dozen panthers. Hyenas, wolves, and wild cats are numerous; the latter are grey colour with long fur coats. There are grey squirrels and flying squirrels; rats, mice, moles, and snakes. Doveton brought back one poisonous snake—the *echis* viper—and saw a kind of whip-snake with fangs. Of small game—pheasants, partridges, grouse, quail, snipe and wildfowl—there is plenty (see also Dr. Bushel's paper).

In August the plateau is a mass of wild flowers of many different varieties, having the appearance of a gigantic wild garden, beautiful in colouring and fragrant with perfume. There is much wild thyme, and

POTALA AT JE-HO.

another sweet-smelling plant resembling lavender, used by the Chinese as fodder.

The principal trees are the silver birch, pine, larch, willow, cyprus, walnut, and holm oak. There is a perfect jungle of thorny undergrowth and long yellow grass. The holly tree is common.

Doveton thinks that "the forests of the Wei-ch'ang will in a few years be a thing of the past." Not so long ago the whole country between longs. 117° and 119°, and from lat. 41° right up to the Shira-muren, was dense forest. Now what is known as the "Great Forest," only covers an area of about 100 square miles of the north-eastern corner between the sources of the Ying Ho (north and south branches), I-sün Ho, Hsiao Lan Ho, and San Tao Ho. Thickly wooded slopes also extend

along the west side of the I Sün Ho, and south-west towards the Lao-ling (pass). To the west of a line drawn 5 miles from the source of the San-tao Ho to the source of the Meng-kuei Kou there are no forests, and only a few trees, which the Chinese are fast cutting down. South of the Meng-kuei Kou and of Tung Ta-po are some thickly wooded hills.

It is to be noted that, as a general rule, the southern and western slopes are bare, nearly all the timber growing on the northern and eastern slopes. Hundreds of carts are constantly engaged carrying wood west to Dolon-nor, east to Ch'ih-fêng, north to Chin-p'eng; while a good many find their way south towards Jeho.

Here I can only very briefly summarize some of the results of our explorations in that region.

(1) We have surveyed, from their sources to the sea, all the principal rivers, the Lao and Hsi Liao and their branches, the Ta and Hsiao Ling, the Lan, the Pei, the Hün or Yün Ting, the Sang Kan, and the Chü Ma.

(2) All the main routes, and many by-routes, through hitherto unsurveyed tracts have been mapped.

(3) We have located on the map a great many gold- and silver-bearing formations, as well as nearly all the coalfields, some of which have been surveyed and examined by mining engineers.

(4) The boundaries of the Wei-ch'ang have been definitely determined, with a greatly reduced area.

(5) The mystery of the Pai ch'a mountain has been cleared up. The accounts by the early explorers, repeated in all subsequent works and maps (even in the latest French geography, in which Père L. Richard speaks of the Wei-shan (?) as having the highest peak in Chih-li, "Le Pétcha qui atteint 3000 metres environ," see p. 76), that there is a mountain 10,000 to 15,000 feet high called Pai-ch'a or Pé tcha (there are as many different ways of spelling it as there are stories about it) in the north-eastern corner of the Wei-ch'ang, have been proved to be incorrect. Five British and two German travellers who have visited the neighbourhood since 1900 are all agreed as to the absence of any mountain of that name, and, further, that no peak of the Great Hing-an range between lat. 41° and 44° N. exceeds 7000 feet above sea-level. In 1904 Doveton ascended what, there can be no doubt, was the highest mountain in the Wei-ch'ang, and the one to which Verbiest referred. Doveton computes it to be 6500 feet above sea-level, and states that the local name is Ta-Kuang-ting-tzu, a name which has not hitherto appeared on any foreign map.

Pai-ch'a is the name of a tributary of the Shira-muren (or Huang Ho), whose headwaters (at least those which are clear) take their rise on the plateau close by, and gives its name to the district. I am unable to say definitely why this stream has been called Pai-ch'a, but hazard the conclusion that it may mean "White Branch or Fork" as opposed to the "Huang or Yellow Branch" of the Shira-muren. The

waters of the Pai-ch'a are clear, those of the Shira-muren turbid. For similar reasons, the Huang Ho or Shira-muren might be said to take its rise in the mountains north of lat. 43°, and not on the Pai-ch'a plateau, for it is the Pao-li-kou flowing from the north, and not the southern headwaters which are yellow, the southern branches being clear.

(6) The true course of the Hsi Liao Ho between long. 118° and 124° E. has been defined, and the long-standing misconception as to its real course after its junction with the Shira-muren has been removed. This survey was done by Captain Gunter, R.A.M.C., in 1903.

(7) The position of several important towns, such as Ch'ih-feng

TOMB PREPARED FOR H.I.M. THE DOWAGER-EMPRESS OF CHINA AT TUNG LING.

Hsien (Hata), K'u-lu-kou, and Wu-tan-ch'êng, have been accurately determined; other considerable market towns, not marked on any map (even on the latest one-to-a-million German sheets of this region), have been located, and some completely blank spaces have been filled with names.

(8) A valuable survey by Captain Mahon, R.E., was executed in 1902 to connect up the two surveys of portions of the Hün Ho, done by the Survey of India in 1900–01, the one section that on the Hsüan-hua plateau, and the other on the Chih-li plain. The river cuts its way through deep gorges in the Hing-an range—here completely bare of trees—affording some very grand scenery.

(9) The previously unexplored hills north and west of Peking have

been examined and partly surveyed, and additional geographical information collected.

Map of Inner Chih-li Province.

Leaving Outer Chih-li and coming inside the Great Wall, I should like to mention a splendid piece of survey work, the first regular triangulation done in China proper, if we except Wei-hai-wei, Ch'ing-tao, and perhaps some parts of Yün-nan. I refer to the "Map of Part of Chih-li Province," on a scale of 2 miles to an inch, produced by the Survey of India. Only those who have tried accurate triangulating and surveying in China can fully appreciate the amount of work which this map means. These surveys were carried out during the operations in North China in 1900–01, occupying less than eight months, by a single section of the Survey of India, under Major Renny-Tailyour and Captain Ryder, assisted by some officers and men of the China Field Force.

Owing to the curious and, I believe, still partly unexplained haze, which covers the hills and valleys of North China (and indeed the whole of the mountainous regions), to the great cold of winter, and the heavy rains of summer, triangulation and survey work are frequently interrupted. This haze is no doubt in great part due to impalpable Mongolian dust in suspension, such as Richthofen considers may have originally assisted in the formation of the loëss of North China. But, so far as I have observed, these thick hazes extend southwards and westwards far beyond the limit of the loëss, and some other reason is required adequately to explain this phenomenon. Were they due only to heat and moisture, one would expect to find the atmosphere in North China clear during the winter months. But this is not the case. The loëss formation itself is not easily accounted for. I have seen vertical walls of it at an elevation of 5000 feet above sea-level, with extensive beds of water-worn boulders, stones, and shingle buried in the middle. How did they come there? Mr. Kingsmill and others may scoff at Richthofen's theory regarding the loëss, but have they provided a better one in affirming it to be a "marine deposit"? Richthofen, in one of his "Letters," asks for a geological map of the Chih-li plain, to show the distribution of the loëss and alluvial deposits. So far as I am aware, the making of such a map is one of the many things in China still remaining to be done.

I should like here to offer a word of tribute to the late Baron von Richthofen's splendid pioneer work in China. Wherever my fellow-travellers and I have been we have always received valuable assistance from the records he has left of his work, which, considering the difficulties with which he had to contend in earlier days, are remarkably accurate.

When the map of Inner Chih-li was published, it was considered so good that it has been incorporated into the maps of China produced

by most other nations, not excepting the Chinese, who, ever quick to utilize the exertions of others, have had it transliterated into their own language. To those accustomed only to the usual small-scale, somewhat empty-looking maps of China, this one gives a better idea than anything I have seen of the density of population in the Great Plain. The villages shown fall far short of the actual number, yet they average less than a mile apart. Each village has in and around it a certain number of trees (the number depending upon the prosperity of the inhabitants), and though the rest of the plain is treeless, the effect produced on the eye of any one standing in its centre, by the grouping of the villages, is that of an unbroken forest. The difficulties of map-making in the Great Plain are further enhanced by the yearly changes in the river-beds and in the distribution of the water. What are lakes one year are dry land the next, and *vice versâ*. Take the most recent case of the Hün Ho. Prior to 1896 it joined the Pei Ho at Tientsin; now its former bed is dry, and it joins the same river 10 miles higher up. A comparison of the War Office map of Tientsin District, 1 inch to 1 mile, with any map existing prior to 1901, will demonstrate the extent to which these remarks apply.

Other difficulties with which scientific exploration and survey work in China have to contend are the ever-present crowds of people—not, as a rule, boisterous or threatening, but merely inquisitive, anxious to acquire information. Then payments must be made personally, and not through servants. The awkward currency necessitates money being carried by the hundredweight, and much labour in arithmetical calculations. This trouble is, however, abating, thanks to the new 10-cash copper coins, silver dollars, and paper money, which each province is turning out wholesale, and which find a ready circulation. Lastly, there is the prodigal disregard of the value of time, which greatly retards progression in a hundred different ways.

McAndrew and Kirkpatrick's Journey in Outer Chih-li and down Yellow River.

Before quitting the subject of the first part of this paper, I wish to refer to a journey accomplished in 1905 by two British officers (Major G. B. McAndrew, Lincolnshire Regiment, and Captain Kirkpatrick, R.A.) when proceeding on a shooting expedition to the Alashan mountains. I had hoped Major McAndrew would himself have been able to read a paper, but he was obliged to leave suddenly for South Africa, and thus we have been deprived of an interesting record. Although the journey was made only last year, I believe I am correct in stating that these two travellers were the first British subjects to follow the course of the Huang Ho from Pao-t'ou to T'ung-kuan-T'ing, a distance of roughly 556 miles. Though several travellers have crossed

it, McAndrew and Kirkpatrick would have been the first foreigners of any nationality to have accomplished this journey, but that the year previously (1904), two German officers, Lieut. von Mutius and Captain Count von Magnes, had, I believe, come down the same section of the river in a boat as far as T'ung-kuan. They were the first foreigners to traverse this river in its great north and south bend. Lieut. Campbell, R.A., crossed it at Wu-pao on a journey from Peking to India in 1904, and Colonel Bruce crossed it at about the same place on his recent journey in the opposite direction. McAndrew's route-traverse is the first foreign survey of this length of the river, and, added to the work of Indian surveyors who accompanied Nathan, Hunter, Webster, and others during recent years, we have now a complete and fairly accurate chart of this much-discussed and not very well-known river from Pao-t'ou to the sea. The late Captain Watts-Jones, R.E., had he been spared, would have supplied us with the missing sections from Ning-hsia; but after his companion had been drowned by the collapse of their raft, he himself was cruelly done to death in 1900 at Kuei-hua-ch'eng. I do not think the German officers referred to published an account of their journey, which is much to be regretted. McAndrew and Kirkpatrick were also, I believe, the first foreigners to shoot the famous (from a Chinese point of view) and dangerous rapids at San-men, east of T'ung-kuan, up which no boats can proceed.

The route they traversed was—

	Miles.	Days.	Rate per day.
Peking to Kalgan, by cart	110	5	22
Kalgan to Kuei-hua-ch'eng, by cart	191	12	16
Kuei-hua-ch'eng to Hsiao-na-ling (in the Pei Shan) and back	124	6	21
Kuei-hua-ch'eng to Palsy Bulong (Pa-tzu-pu-lün)	182	7	26
Palsy Bulong to Pao-t'ou	62½	3	20
Pao-t'ou to Ho-k'ou	73	3	24
Ho-k'ou to T'ung-kuan	483	20	24
T'ung-kuan to Mêng Hsien	247	14	17½
Total	1472½	70	20 to 21

The Huang Ho, or Yellow river—the "Red Queen" of the Mongols—was followed from a point 80 miles above Pao-t'ou to Mêng Hsien, a total distance of 880 miles, the whole of which (with the exception of a stretch of a few miles between Ho-k'ou and Pao-tê-chên) was mapped on a scale of 1 mile to an inch.

In May, in the ravines of the Maniula hills, the travellers noticed a yellow rose with strong perfume, blossoming in great profusion. This must be a very hardy plant to blossom so soon after the severe winter of Mongolia. It might do well at home in the bleak districts of Scotland.

An interesting point is the curious action of the wind-driven sand

on the sides of the cliffs against which it is blown. It seems to find a soft place, and makes a kind of bed or pit. An eddy is thus created, with the result that deep holes—in places, regular caves—are excavated in the rocks, much like the pot-holes of the Yangtzu river.

The K'ou-wai, the part of Southern Mongolia which the party traversed from Kalgan to Kuei-hua-ch'eng, is a land of dead rivers and dying lakes. "In May, 1905," McAndrew states, "all the lakes shown on the map near the outer Kalgan to Kuei-hua-ch'eng road had dried up. Angul Nor, Kir Nor, T'ai Ha Nor, hold no water, and the streams that used to feed Kir Nor are also dry."

In June, 1902, Mr. C. W. Campbell described the Lake Angul Nor, the largest sheet of water in the Chakkar country, thus: "In 1889, I

VIEW OF THE FAMOUS MONGOL MECCA, WU-T'AI SHAN, IN SHAN-HSI PROVINCE.

launched a Berthon on this lake. I rowed across it from north to south, and found no greater depth than 4½ feet. The Khara-usu river in June to July, 1899, was a mere trickle of water. In June, 1902, it was a series of shallow pools." Thus, on the chart given to McAndrew and Kirkpatrick, Angul Nor was shown as it was drawn by the Indian surveyor who accompanied Mr. Campbell in 1902—as a large sheet of water. In 1904, Mr. Larsen informed me that the lake was no more, and the river feeding it completely dried up. This is corroborated by McAndrew, with the additional information that the same fate has overtaken all the other lakes and rivers.

Two reasons are put forward for this drying up of the lakes and rivers. First, the undulating grass lands which prevail in this part of Mongolia being hard and dry, when rain falls it quickly runs off into the watercourses and collects in the lakes. But the invasion of the

Chinese farmer has altered the face of the land, which, being now ploughed up for the crops, drinks up all the water as it falls. Once the soil is broken, it is very porous; hence the lakes, receiving no fresh supplies, gradually dry up, leaving on the surface a white-coloured efflorescent deposit like saltpetre, a sufficient reason for the absence of fish or other living creatures.

The above is the theory of the Protestant missionaries. The Belgian Roman Catholic missionaries have a different one. In their opinion the first reason does not account for the drying up of the springs in the hills and mountains. They affirm that the rainfall has been steadily decreasing since eight or ten years, until latterly there has been practically none at all, so that even the springs are dry.

Perhaps the second theory may be to some extent the result of the first. The absence of surface water over a large area would, I suppose, be likely to reduce the local rainfall to some extent.

The hills through which the Yellow river passes are monotonous carboniferous sandstone, with loess on the top. They are bare and treeless, the charcoal-burner quickly demolishing whatever is growing. The jujube plum and mulberry are cultivated in the valley bottoms and level spots. Patches of tamarisk scrub—like the "jow" on the banks of the Ganges—and a stunted broom with yellow flower were seen along the banks. The Mongolian grass country, which in summer is a mass of flowers, was quite bare. West of Kuei-hua ch'eng, in May, the dwarf purple iris, 4 inches high, growing in compact clumps, made a fine show.

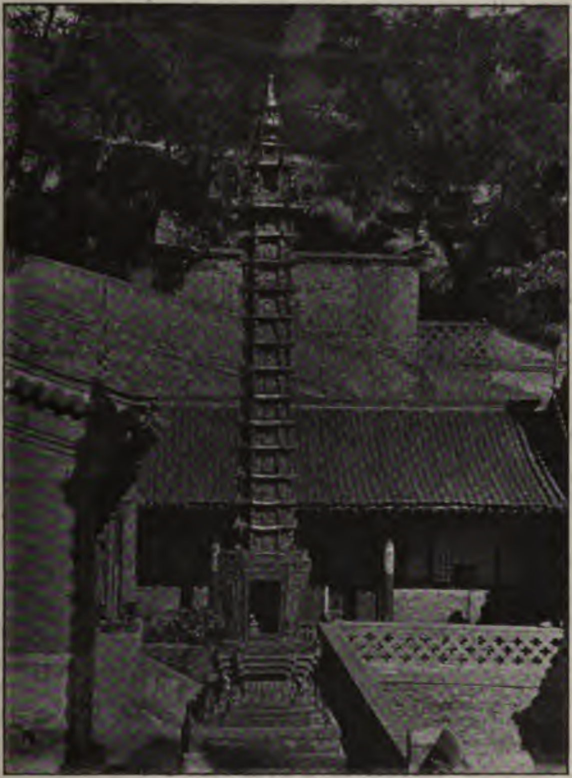
The travellers did not get any shooting to speak of, owing to lack of time to remain long enough in any one locality. The *huang-yang* (the yellow antelope) was seen everywhere in Mongolia, in herds of six to twenty, often grazing among the sheep and cattle. The *Ovis argili* (pai yang) are in fair numbers in the hills north of the Kuei-hua-ch'eng, but they are being fast thinned by the Chinese colonists. A herd which numbered a hundred only a few years ago is now thirty. *Roe deer* (p'ao-tzu) are very common on the hills north of Kuei-hua. This deer, which in England is associated with woods and thickets, is found here on bare lonely hills. The *red deer:* there are some in the Muniula hills, where the Mongols jealously guard them, killing a few each year for the horns in velvet, which are valuable for medicinal purposes. The *wild goat* (shan-yang): a few in the Maniula hills. They are dark brown colour, with massive horns. *Wolves* are common in Shan-hsi and Shen-hsi, along the Yellow river.

Great numbers of *small rodents* are found in the grass country of Mongolia. The commonest is a rat with a yellow hairy tail, the huang-shu (*Cricetus fumentarius*); it is considered a delicacy by Chinese gourmets.

Wildfowl abound in the pools and rivers, specially the grey goose

in immense numbers. Partridges, sand-grouse, pheasants, and a few snipe were seen at various points along the route, also numerous wild pigeons (blue rocks).

A good many snakes were seen on the banks of the Huang Ho. Longest, 3 feet 6 inches; backs, light green; bellies pale yellow; ditto under head, which is V-shaped; small hood; erectile fangs; bodies narrow suddenly near the end of tails; crimson splashes each side of head. One had six frogs in its stomach; it had also five of its own



GOLDEN PAGODA IN TEMPLE AT WU-T'AI SHAN.

eggs, joined together by a kind of string, each egg about the size of a robin's.

The Chinese are very fond of the Lung-men for its rocky scenery. Rapids are frequent from 30 miles below Pao-tê-chon until Yu-ming-k'ou. The greatest depth obtained was 18 feet, but there are probably many deeper places. The temperature of the water was 71° Fahr. on June 19. The speed of the current varies greatly, in some places where deep and smooth, flowing at 6 miles an hour. A little further,

and it may slow down to a mile an hour. In short, this section of the river has some of the characteristics of the Yang-tze gorges. According to the Chinese boatmen, the three most dangerous places are the Lung-wang waterfall, the Yu-ming-k'ou narrows, and the San-men rapids.

At Hu-k'ou, one day's journey north of the narrows of Lung-men, and 250 miles below Pao-tê-chen, is the Lung-wang (Dragon Prince) waterfall, which was discovered (for the foreign geographer, at all events) by McAndrew and party. Here this immense volume of tawny-coloured water plunges down some 30 to 40 feet in a narrow deep crevasse; the falls are hidden in the clouds of spray. The boats are dragged round with great difficulty overland for about 1200 yards. Major McAndrew thus describes this interesting locality—

"The scenery down the Yellow river from Ho-k'ou to Yu-men-k'ou, and again below T'ung-tuan-t'ing, is very fine in places, but also monotonous. The hills are all bare, of uniform height, and topped with a smooth cap of loess. The cliffs that line the river are all about the same height, and of the same reddish-grey sandstone. There are, however, a few spots that are well worth a visit. One of these is the Lung-wang (the Dragon Prince) waterfall. Above the fall the river is about 200 yards wide, and the channel is broken up by rocky ledges. The bulk of the water, a tumbling mass of a tawny orange colour, flecked with foam, plunges into a narrow crack in its bed near the Shen-hsi shore. The depth of the fall is about 40 feet, but the bottom is a seething cauldron which cannot properly be seen owing to the clouds of spray that rise from it. The remainder of the water falls into the same fissure at right angles to the main fall in a series of cascades 500 yards long. This is a region of wonders and paradoxes. There is a spot some distance below the fall where, standing on the roadway by the river-bank and looking up-stream, one sees a cloud of blue smoke rising from the middle of the water without apparent cause, while at one's feet the whole volume of a great river rushes for 9 li (3 miles) down a narrow fissure in places not more than 15 yards, and nowhere more than 40 yards, wide. One can, I say, stand and see, but one cannot in June (the time of our visit) conveniently sit on the rocks by the side of the roadway, because they have been baked burning hot by the rays of a powerful sun, and one cannot sit on the roadway itself, because it is a mass of ice 12 feet thick. The presence of this ice in midsummer so far south comes on one as a great surprise. The sun heat in this gorge is intense, and the water of the Yellow river itself 71° Fahr. Yet there are great banks of ice on the rocky ledges at the side of the water. One of these on June 20 was 100 yards long, 5 yards wide, and 12 feet thick. This ice, I believe, generally melts away by the end of July, and long before June gets so covered up by dirt and dust, that one does not realize at first that it is ice, but by cutting into it clear blocks can be got. When the ice breaks up in spring it floats down,

and is carried away over the falls, and gets jammed in the narrow fissure below. The force of the water churns it up on to the banks. The river here must be a grand sight in March, rushing through piles of ice 30 or 40 feet high.

A day's journey below the Dragon King falls is the famous Lung Men gorge, ending in the straits of Yu-men-k'ou. This gorge is about 30 li long. The river is a deep, still stream 150 yards wide, and races between precipices of reddish-grey sandstone 800 feet high. Above the precipices the cone-shaped tops of the hills covered with green scrub rise for another 800 feet. At Yu-men-k'ou the banks contract to 60 yards, and upon each side of the straits there is a fine temple. Coming down-stream, when one's boat rushes through this strait there is a regular transformation scene, the river suddenly leaving the hills and spreading out over a sandy flat to a breadth of 1½ mile. Yu-men-k'ou is justly famous amongst the Chinese, who are great lovers of rock scenery. Another famous spot well worth a visit is San-men. Below the rapids, and until the river leaves the hills above Yeh-shu, there is as fine rock and hill scenery as anywhere along its course."

At San-men, east of T'ung-kuan, the river enters the hills, and rapids occur which form an impassable barrier to ascending traffic (boats reach a point 30 li below the rapids), while considerable danger attends even the descent. At this point the river makes two right-angled bends 150 yards apart. There are two sets of "gates," having three main channels, used in turn according to the water-level of the river. McAndrew failed to attain statistics as to the number of accidents, owing to the reluctance the boatmen have of mentioning the subject, which is considered unlucky.

As regards navigability, there is very little through traffic; such boats as do descend are very roughly put together at Wu-pao Hsien, and are broken up at the end of their journey. The chief cargoes are coal and liquorice, the latter from Ning-hsia; forty boat-loads are said to come down annually.

From Yu-men k'ou to T'ung-kuan-T'ing.

The navigation is obstructed by the shifting banks and shallows. There is a large traffic in coal from Shih-chia-t'an to Chuang-wa, trans-shipped at Yu-men from smaller to larger boats.

Thus for steam navigation the river above Mêng Hsien would appear to be at present quite unsuited. The cost of making locks at the San-men rapids might repay the outlay, as this would open up the waterways to Hsi-an Fu and Lung-men; above this point steam traffic would not pay.

Coal-mines are widely distributed all along this section of the Yellow river, hardly a point more than 60 miles from some coal-working or other, the average cost being 1 cash ($\frac{1}{35}$ of a penny) per chin

($1\frac{1}{3}$ lb.). Owing to difficulty of transport, the price rapidly increases with the distance from the mine.

During the journey the temperature ranged from 18° Fahr. on April 22 near Kalgan, to 105° Fahr. in July in tents on the Yellow river bank. Rainfall, water, and fuel are all scarce in the K'ou-wai. A curious feature is that all along the Yellow river from Hei-k'ou to Yu-men, the arable tracks are all on the hilltops, where the loëss is, and the valleys, which are full of rocks, are not cultivated. The people live chiefly on small millet and potatoes, which are grown everywhere. There are some irrigation works being set on foot by the Chinese officials along the northern bend of the Yellow river.

Above Lung-men communication along the river-banks is almost non-existent. This necessitated sending the baggage-mules and riding-ponies by a big *détour*, when McAndrew and party took to boats at Chi-K'ou on June 14. The two parties re-united at P'u-chou Fu on the 31st. The baggage animals covered 1265 li, or about 380 miles; that is, 25 miles a day for seventeen consecutive days, with two halts of one day each. This illustrates the oft-repeated evidence of travellers regarding the capabilities of Chinese men and mules as marchers.

Journeys in Hills west of Peking and to the Wu-t'ai Mountains.

I pass now to that part of my subject relating to recent travels in the mountains west and south-west of Peking.

My remarks fall naturally into two divisions. The first deals with a visit, by previously unsurveyed routes, to the Hsiao (or Lesser) Wu-t'ai Shan; the second, also by previously unsurveyed routes, to the time-honoured Buddhist or Lama shrine of Wu-t'ai Shan (Five-terrace mountain). The object of these travels was to connect up with the work of previous British explorers.

Owing to various causes, it has not been possible to prepare in time a detailed reduction of our survey work in the hills west and south-west of Peking; consequently I have utilized for purposes of illustration the beautiful maps of my American friend and brother explorer, Mr. Bailey Willis, to whom I shall have occasion again to refer. On these maps have been entered rough reductions of the surveys we made on these occasions.

Our small expedition left Tientsin on August 21, 1905, and proceeded by rail to the now famous Hsi Ling, or Imperial Western Tombs. It was the troubles of 1900 which first brought these and so many other important, though little explored, places of interest into prominence. When history is written, what a debt—geographical and otherwise—we shall find owing to those much-abused and misguided patriots, "the Boxers"! To my mind the Chinese conception of an imperial burial-ground is a very grand one, only equalled by the Taj at Agra and the Great Pyramid of Egypt. The latter make up in durability what they

lack in picturesque surroundings, and in natural, as opposed to artificial, grandeur. Cecil Rhodes seems to have been, in some measure, imbued with the Chinese idea, in choosing for his last resting-place the Matoppo hills in South Africa.

The Imperial Tombs east, west, and north of Peking (the first two Manchu, the last-named Ming) have been often described by abler pens than mine. Notably the Tung Ling by Mr. F. H. Bourne in the Royal Geographical Society's *Journal* of 1872.

It is customary for Chinese imperial tombs to face the south, and to be backed by an amphitheatre of hills—whenever possible, steep, broken, and inaccessible. Another peculiarity in regard to both the Tung and

RUINS OF ANCIENT TEMPLE ON SUMMIT OF CHUNG-T'AI, 9600 FEET ABOVE SEA-LEVEL.

Hsi Ling (east and west imperial tombs) is that the Great Wall (or branches of it), for the length where it follows the crest of the hills behind the tombs, has been demolished, presumably so as not to interfere with the Feng-shui of the departed spirits. Though, since 1900, the Hsi Ling has become a popular resort for tourists and holiday makers (as well as for sportsmen who pick up a few pheasants there), few have visited the Tung Ling.

The future burial-places of their Imperial Majesties, the present Emperor and the Dowager-Empress of China, are interesting. The site of the last resting-place of the present emperor lies in the north-east corner of the Hsi Ling. At the time of our visit work on it had not yet commenced. The Dowager-Empress has had a very fine mausoleum

prepared in the Tung Ling, alongside her late consort, Hsien-fêng, and near her great ancestors, K'ang-hsi and Ch'ien-lung. The well-known custom of preparing a resting-place while yet living is carried to a much greater length in China than it is in this country. The ambition of every Chinese man is to get a son, and a son's earliest act of reverence is to present his father with a coffin. I remember, when travelling in unfrequented parts of Western China, seeing an old man and his wife asleep side by side, each upon a straw-covered coffin with a couple of bricks for pillows.

The country we are about to enter is of considerable interest geographically, geologically, and religiously; this will be readily admitted when we recall the names of some of the distinguished travellers who have been attracted to it—such as Richthofen, Potanin, Rockhill, Edkins, and others, not to mention the great Manchu Emperor Ch'ien-lung.

Rockhill states that "since the Imperial visit of 1786, none of the emperors have been here." But this must have been a mistake, because I have in my possession the imperial route-book compiled for the Emperor Chia-ching, who visited the shrine in the sixteenth year of his reign (A.D. 1812). The last foreigners, other than missionaries, to visit Wu-t'ai Shan and neighbourhood prior to our arrival, were a party of Americans under the direction of the well-known geologist, Mr. Bailey-Willis, sent out by the Carnegie Institute of Washington to take up the examination of the geology of the eastern side of Shan-hsi which Richthofen began, much as the German explorer, Dr. Tafel, has devoted his attention to the western side. I am indebted to Mr. Willis for advance proof copies of the maps he produced. As a sample of the kind of work which a small scientifically equipped party with a well-furnished banking account can accomplish, these sheets are noteworthy. I was glad to be able to render some assistance to the Bailey-Willis expedition, by which they picked up and carried on the triangulation which Major Renny-Tailyour and Captain Ryder had made during the operations of 1900–1901. Their surveys were executed with plane-table and alidade.

Leaving the hospitable shelter of the lama temple at the western tombs early on August 22, we wandered through the beautiful parks surrounding the last resting-place of the Emperor Tao Kuang and his somewhat numerous consorts, and were soon ascending a long valley bounded on its northern side by a precipitous, inaccessible granite cliff of that fantastic appearance dear to the Chinese artistic mind, as is well depicted in their numerous drawings and ornamental gardens. These cliffs and curiously shaped peaks are a feature of the hill-country west and south-west of Peking recently described by Mr. E. C. Young in this Society's *Journal*. A few months earlier I had visited this little-known region (marked blank on all the published maps) *en route* to the Hsiao (or Lesser) Wu-t'ai Shan, and I can thus corroborate all that Mr.

Young says, especially as to the terrible fatigue engendered by having to follow river-beds filled with rounded stones of every dimension, from shingle to enormous boulders, which the character of the hills and the absence of all roads make a necessary evil. Here and there, above high-water mark, maybe a pathway exists, but, as each freshet descends, any slight evenness which the traffic may have worn along the river-bed is soon obliterated. Moreover, the limited range of view, and the necessity whenever a hill is ascended of again descending to the valley bottom, make surveying difficult and protracted. This remark applies equally to survey work in the loëss formation. So far as I can ascertain from published accounts, I must have been the second British subject to ascend the Lesser Wu-t'ai, the first having been Mr. Savage Landor, who published a description of his journey in the *Fortnightly Review* for September, 1894.

This is the more remarkable because this mountain is only 75 miles as the crow flies, or seven or eight days' march from Peking. Moreover, it is, with the exception of its no higher, but more celebrated sister further south, the highest mountain in the Chinese Empire between long. 108° and 127° E. Dr. von Möllendorff, the first foreigner to ascend the Lesser Wu-t'ai in 1873, determined the height of the Pei Ting, or Northern peak, to be 3491 metres, or 11,450 feet above sea-level.

This is some 1400 feet above Richthofen's and Rockhill's heights for the Greater Wu-t'ai, and from my own observations I am inclined to think that Möllendorff overestimated the height. I approached the mountain by an unsurveyed route from the south, and ascended the Nan-ting (or south peak), which is slightly lower than the north and central peaks. My observations lead me to conclude that the south peak is about 9600 feet, and the north peak probably 300 feet to 400 feet higher. The shape given to the mountain on Möllendorff's map is substantially correct.

On the day of our visit the mountain was still white with a heavy snowfall, which occurred during the night nine days previously (May 18–19), and extended down to 5000 feet. On that night I was sleeping in the old temple on the summit of Pai-hua Shan (White Flower mountain), 7000 feet (Möllendorff makes it 800 feet higher). This well-known mountain lies in a direct line between the Lesser Wu-t'ai and Peking, from which it can be seen on a clear day. It is often visited by foreigners residing in the capital. I had hoped to get a view of Wu-t'ai and Peking from Pai-hua ; but, to my great disappointment, on reaching the summit, found everything hidden in the impenetrable haze, to which reference has already been made. We could scarcely see the neighbouring hills. At 7 p.m. the thermometer stood at 50°, and the atmosphere was oppressive.

During the night, however, a transformation scene was enacted. The thermometer dropped to 33°, snow fell heavily, and in the morning

we beheld a sight which rewarded us for the cold discomfort of the night, and which only the artist's brush and the poet's pen could have adequately depicted and described. On the one side, a confused mass of yellow-coloured mountains and deep, violet-hued ravines, filled with the morning mist, surmounted by the five snow-capped peaks of Wu-t'ai and neighbouring high mountains. On the opposite side, beyond the surrounding hills, could be clearly seen the great plain of Chih-li, with the walls and minarets of Peking (about 45 miles distant in a bee-line) and the silvery streaks of the Hün and Chü-ma rivers meandering to the far horizon. The photograph here shown gives but an inadequate idea of this magnificent panorama, but is valuable as showing what can be done with a Kodak hand-camera and ordinary rectilinear lens in North China *when* the atmosphere is clear; at other times, owing to the haze, only failure results when trying distant landscape views. Another difficulty in obtaining good photographs of the geographical features of North China is the prevailing yellow hue of the ground and mountains, the latter generally quite bare; this, with a background of clear blue sky, makes, under ordinary conditions of photography, insufficient contrast. I would strongly advise all who wish to obtain good landscape pictures in North China to use colour-filters and orthochromatic plates. This applies equally to most of the imperial palaces, tombs, and temples, owing to the yellow roofs, the reddish-pink walls, and woodwork picked out with blue, green, red, and gold—splendid subjects indeed for colour photography. The distance in a bee-line between Pai-hua and the Lesser Wu-t'ai is between 25 and 30 miles, according to which of the five peaks is chosen, but such is the nature of the country that it takes five days to march it.

These western hills are of great interest to the geologist, owing to the way in which the strata are exposed, affording good opportunities for examination *in situ*. The effect, too, of the torrential rains is marked, and the country is so broken that only fruit can be grown for export. The valleys are sparsely inhabited, the people poor, and the crops only sufficient for local requirements. This applies to the whole belt, until the extremely fertile T'ao-hua valley is reached.

Concerning the Great Wall, I may remark that its position is wrongly shown on the maps of the day in quite a number of places, while in others it has ceased to exist—the only places where it forms a substantial boundary being in the valley bottoms, on the passes, and where it crosses main routes. These remarks apply with particular force to the branch running south-west from the Nan-k'ou pass, and forming the boundary of Chih-li and Shan-hsi provinces.

(*To be continued.*)

NOTES ON A JOURNEY THROUGH THE WESTERN HIMALAYA.

By T. G. LONGSTAFF, M.A., M.D.

THE following notes deal with portions of Kumaon, Nepal, Tibet, and Garhwal, which I visited in the course of a six months' journey last year (May to October, 1905), the distance covered being about 900 miles on the map. This journey was originally intended to be a purely mountaineering excursion, and I was accompanied by an Alpine guide from Courmayeur, Alexis Brocherel, with his brother Henri as porter.

I have already dealt with the mountaineering aspects of this trip in a previous number (August, 1906) of the *Alpine Journal* (vol. 23, pp. 202–226), to which I shall refer those interested in the subject. A considerable number of photographs of topographical interest were obtained. I estimated my altitudes with a 4½-inch Watkin aneroid by Hicks, which was constantly compared with the altitudes on the G.T.S. maps. In order to diminish the chances of over-estimating my heights, I gave the barometer only half a minute to settle after putting it into gear. In consequence, its readings were almost invariably higher than those shown on the maps, but I have made no allowance for this probable addition to my heights. I had no idea that I should be able to visit Tibet until I had left civilization behind, and was therefore unprovided with instruments and maps which I should otherwise have taken with me.

Leaving Almora on May 14, we proceeded by the usual but very interesting route to the head of the Milam valley, and pitched our camp close to the hamlets of Ganagarh and Pañchu (altitude 11,100 feet) on May 27, our arrangements having been greatly facilitated by the kind help of Mr. C. A. Sherring, I.C.S., the deputy commissioner of Almora, and of Kishen Singh, Rai Bahadur, the Pandit 'A-K' of the trans-frontier survey, whom we met at Mansiari. In the upper Milam valley, the strong wind (*rani ka pankha* of the foothills) which blows daily up the valley is very noticeable, and the general aspect of the country, with its climatic conditions, fauna, and flora, undergo a marked change, and, approximating to those of the neighbouring part of Tibet (Hundes), form an extraordinary contrast to the luxuriance of the semi-tropical region which has just been left behind.

The Bhotias had not yet come up to their summer quarters at Martoli and Milam in any considerable numbers, but we passed a few strings of grain-laden sheep, and ploughing with *jhobus* had just commenced. Though the main valley is practically treeless above Baugdiar (8550 feet), birch trees grow up to about 12,000 feet on the northward-facing slopes of the lateral valleys, while rhododendron thickets extend 1000 feet higher. At Martoli I obtained specimens of the red-billed chough (*Graculus eremita*), which belongs rather to the Tibetan region,

and is not nearly so common here as the Alpine chough (*Pyrrhocorax alpinus*).

Several days were spent on the Pañchu glacier, which is at present, and has been for some time, receding. Flocks of *Colomba leuconota* and *Accontor nepalensis* were seen feeding about the snow-covered moraines up to 15,000 feet. The afternoons were generally cloudy, and there were some light rain and snow falls.

On June 2 we crossed a difficult snow-pass at the head of the Pañchu glacier, directly under the south-eastern ridge of the eastern peak (24,379 feet) of Nanda Devi, its height being 17,750 feet, according to my Watkin aneroid. To our surprise we found ourselves at the head of the Lwanl valley, and not on the Kumaon-Garhwal water-parting as indicated on the G.T.S. maps. This pass, for which I would suggest the name Pañchu, should only be crossed by experienced mountaineers, and no attempt should be made to take native coolies or shikaris over it. After a steep but easy descent, we found ourselves beside the rapidly shrinking glacier which rises below the eastern cliffs of Nanda-Devi (east peak), and descended the Lwanl valley, sleeping in the open some way below the summer grazing-ground of Narspan Patti, and regaining the main valley next day.

I was surprised by hearing the Bhotias use the word *gal* (pron. *gull*) for glacier, the identical word being in use by the Svans of the Western Caucasus.

On June 5 we started to ascend the Lwanl valley again to its head, making frequent use of great beds of winter avalanche snow, which completely covered the stream in many places, and gave an easy route up the glen for long distances. On June 8 we reached the Kumaon-Garhwal water-parting at 19,000 feet (Watkin), the last two days entailing climbing too difficult for the coolies (*vide Alpine Journal, loc. cit.*). From this point we looked (west) down upon the glaciers at the base of Nanda Devi, and (south) over the Pindri ridge and Traill's pass, which, tradition says, was regularly used long ago, to the Pindri glaciers, from which the Pindar river takes its origin. Next day we tried the south ridge of the east peak of Nanda Devi, but found it would take us at least two days more, for which we had insufficient food.

On June 10–11 we attempted to climb Nanda Kot from the summer grazing-ground of Narspan Patti (Schlagintweit, 13,404 feet; Watkin aneroid, 13,150 feet), but had to turn back at about 21,000 feet, owing to the danger of starting an avalanche.

On June 15 we started up the S'halung glen, which forms the south arm of the Lwanl valley, and on the 18th crossed a difficult pass (18,000 feet, Watkin), for which I suggest the name Poñting, in 18½ hours, being again without coolies. The Poñting glacier, on to which we descended, is crossed by three ranges of cliffs, the two lower of which completely

interrupt it, except for a chaotic ice-fall. None of them are shown on the maps. The glacier is advancing, and its snout (11,600 feet, Watkin) presents a beautiful sight, the clear green ice being raised above the upper edge of the lateral and terminal moraines, and showing no tendency to lower its bed. At this spot I saw a mouse-hare (*ochotona*). This genus is widely distributed through the mountains of Kumaon, Nepal, Tibet, and Garhwal. I obtained specimens in the two latter regions, probably of different species, though the point has not yet been determined. For half a mile below the present termination of the glacier the ground is littered with huge boulders and grassy heaps of moraine stuff, amongst which are groves of rhododendron, birch, and pine, forming a delightful change to the treeless glens in which we had spent the last four weeks.

We reached our camp, which had been sent down to Bangdiar by the main valley, on June 19. Sherring having obtained leave for me to accompany him on his mission to Tibet, we proceeded back through the middle and tropical zones of the lower Gori to Askot, where we joined him on June 27.

Following the track along the right bank of the Kali river, which forms the frontier between Kumaon and Nepal, we reached Garbyang on July 8, having made the distance in eight marches. On July 3, at Tithla, I shot a pair of black-and-yellow grosbeaks out of a small flock in the forest of silver fir there, and am interested to find, on inquiring at the Natural History Museum, that the male was *Pycnorhampus affinis*, while the female was *P. Icteroides*, an interesting case of closely allied species frequenting the same ground, this being about the eastern and western limits of the two species respectively.

On July 9 I visited the Nampa glaciers (roughly indicated in Sheet 37 of the G.T.S., 1 inch = 1 mile), in search of Landor's Lumpa peak, 23,490 feet (*vide* Landor's 'Tibet and Nepal,' chaps. viii. and ix.). Sherring obtained for me two of the four Bhotia coolies who accompanied Landor on this trip, and I took seven others, in order that we might travel as fast as possible, our time being so limited.

Crossing the Kali just above Garbyang, we entered Nepalese territory, and soon came to the Tinker stream, which we crossed close to its junction with the Nampa stream. Crossing this also, we travelled along its left bank through beautiful woods of *Pinus excelsa*, and then over meadows of blue clover and red-blossomed strawberry to the glaciers. These are almost completely covered by surface moraine in the lower portion of their course, and are of great size, though the length of the main ice-stream does not now exceed 5 miles. Two large glaciers, about 4 miles long, separated by a high ridge, flow due north from Nampa peak into the main valley, but do not now join the main ice-stream. The lowest comes down to about 12,500 feet (Watkin), and presents the curious spectacle of having a split tongue. The first

tongue, or snout, is stone covered; then comes a very old moraine area piled up about 100 feet, and dotted over with large silver birches. This is succeeded by the second snout at a considerable level above the first, and which I almost mistook for a separate glacier. I can only explain the formation by supposing that after the old terminal moraine was formed, the glacier began to advance again, and that the advancing snout of the glacier, far from removing the obstruction, was split into two tongues by the wedge-like opposition of the moraine, which was sufficient to keep the eastern arm at an elevation of at least 100 feet above that of the lower or western.

On July 10 we continued on up the main glacier to Landor's highest camping-place (13,200 feet, Landor; 12,680 feet, Watkin). Leaving this camp sometime after 5 a.m., he states (*op. cit.*) that he ascended a peak of 23,490 feet, returning to the same camp at 6 p.m. Leaving most of our impedimenta here, we pushed on with Linka and Gobria, the two Bhotias previously mentioned, and reached the cairns he had erected in 1899. Having damaged my barometer at 15,300 feet, I am unable to do more than guess at the altitude, but believe it to be about 16,500 feet. I found no peak of 23,000 feet in the position indicated by Landor, and Nampa (23,352 feet) lies considerably to the south-west of his route. We returned as rapidly as possible by the same route, and reached Garbyang again on July 11.

Entering Tibet on July 14, in company with Sherring's party, by the easy Lipu Lekh (16,780 feet), we proceeded through Pala and Magram to Taklakot. According to Rawling ('The Great Plateau,' p 251), ours was the third European visit to this place; but, unlike our predecessors, we met with a most friendly reception. Taklakot (Purang) is the largest village in Hundes (Nari-khorsum), and at least equals, if it does not surpass, in importance the summer camp at Gyanema as a trade centre with British India. There are some poplars at Magram—the only trees I saw in Tibet. The altitude of Taklakot is given as 13,300 feet in the maps. The camping-ground is warm and sheltered. On July 16 the shade temperature was 76° Fahr. at 2 p.m., and 54° at 11 p.m. In the neighbouring *rongs* are several considerable hamlets, but Sherring has dealt with this district in his recently published 'Western Tibet and the British Borderland.'

I left Taklakot on July 18 with the two Brocherels and six Byañs Bhotias to examine the western flanks of Gurla Mandhata (Memo-Nam-Nyimri of the G.T.S., Momo-nangli of Strachey, or Nimo-Numgyl of local Tibetans). The altitude of the culminating point is 25,350 feet according to the G.T.S. As long ago as 1864, Webber ('Forests of Upper India,' 1902) noted that the ascent of this peak would probably prove easier than that of any strictly Himalayan peak of an equal altitude, owing to the very high snow-line prevailing in this part of Tibet.

Crossing the Karnali by a good wooden bridge above the big bend which this river makes to the east of Taklakot, we passed through the hamlet of De-la-ling, leaving the tomb of Zarawar Singh on the left. Soon afterwards we crossed the shallow stream of clear water which descends from the first and most southern gorge of the Gurla *massif*.

This gorge runs roughly from east to west, and is bounded on the north by the ridge which culminates in the G.T.S. peak, 22,200 feet. We met a large caravan of Tibetans, with many sheep and laden yaks, evidently bound for the wool market at Taklakot. Turning sharply to the east, we walked along the raised bank of the stream towards the foot of the ridge just mentioned. This raised bank bears a faint resemblance to an ancient moraine, and in the wide torrent bed are scattered large angular boulders, which looked from a distance as if they had been left there by a retreating glacier. We afterwards looked down upon the whole extent of this steep-sided stony gorge. At its head is a relatively low *col*, with snow-streaked peaks springing up from it to the north and south, and other snow-streaked peaks rising into view beyond it to the east. No glacier was visible at the head of the gorge, and the *col* appeared to form a true water-parting.

Commencing the ascent of the ridge itself at noon, we climbed steadily up steep but easy stone slopes for nearly six hours, and, sending the coolies down, camped for the night near the first beds of snow. The height of Bal-Dak is given in the G.T.S. as 15,000 feet, and we were higher than this at noon; considering, also, the complete absence of all vegetation, and size and character of the snow-beds on this south-west slope, I think that our altitude must have been over 18,000 feet.

The weather was cloudy on July 19, and I was suffering from headache, so we passed the day here. My barometer having been broken, and Sherring's hypsometer not being graduated low enough for use at these altitudes, I took the opportunity of tea-making to boil an air-thermometer. By plunging the bulb into the boiling water I got the mercury to oscillate between 169° and 170° Fahr., which, of course, gives a hopeless result (almost 23,000 feet). The air temperature (11 a.m.) was 45° Fahr., the sky being overcast and the sun quite concealed. The observation was comparable to the classical example at Pike's Peak observatory, when a pan of loose snow was set on a hot stove to melt, and in a short time the water in the bottom of the pan began to boil, while the snow on the top of it was yet 3 or 4 inches deep. Again, on July 22 the temperature of a kettle of boiling snow-water at about 20,000 feet was only 165° Fahr., a result which was equally worthless for scientific as for culinary purposes.

This day (July 19) the Himalaya of Nepal and Kumaon were hidden by the clouds, but the view towards the west was very impressive. Kamet (25,443 feet) stood out boldly over the Niti pass at a distance of 100 miles. North of this was the Gangri range, partially snow-clad on its

north-east slopes. Between lay a vast rolling plain, with rounded snowless hills rising from it, and a bend of the infant Satlej winding away into the north-west on its way to the Arabian sea, while the waters of the Karnali at our feet were flowing towards the Bay of Bengal.

On July 20 we got off at 2 a.m., in brilliant moonlight, the thermometer registering 29° Fahr. The Himalaya of Nepal were visible long before sunrise, the first to catch the light being a very high and distant snow-peak bearing slightly east of south-east, and which we estimated to be over 25,000 feet in height. On reference to the map, it appears to be Dhaolagiri, distant 180 miles. Soon we saw Rakas Tal to the north, but Mansarowar remained hidden by the great western shoulder of Gurla. Passing over a steep dome-shaped snow-peak, we found ourselves on a narrow *arête* of snow, with our first uninterrupted view of the summit of Gurla. Below us was spread another glen, shut in by steep walls, and, like the first one already described, narrowing towards its outlet. The upper half (E) was filled by a large glacier, very white in colour, owing to the almost complete absence of moraine-stuff from its surface. For convenience I shall allude to it as the Gurla glacier. The ridge we were on led to the G.T.S. peak (22,200 feet), and then round in a northerly direction to the summit of Gurla. This route being obviously impracticable, we turned back as soon as a series of photographs (*vide Alpine Journal, loc. cit.*) had been secured.

I should like to put on record that the small map published in this *Journal* for 1900 to illustrate the journeys of the brothers Strachey in 1846–8–9, gives a more correct representation of the Gurla group than that retained in the latest sheets of the G.T.S. trans-frontier series. The huge southern glacier does not exist as shown in the latter. This locality lies well to the south of Major Ryder's recent survey; in fact, we were the first to see this side of the mountain, though the northern glaciers are plainly visible from the neighbourhood of Mansarowar lake.

Our next camp was made under an accommodating rock beside the stream flowing from the Gurla glacier, and close to an old lateral moraine, which extends into the open plain below the very constricted mouth of the gorge by which this stream leaves the mountains. Indeed, we found here a very good example of the relatively protective, rather than the destructive, action of a glacier, for the stream had cut deeply through a rocky barrier which had long resisted the action of moving ice.

We next (July 22–23) ascended the great western ridge of Gurla to a height of about 23,000 feet, looking down on to and over the G.T.S. peak, 22,200 feet. This route proving too long and exposed (*vide Alpine Journal, loc. cit.*), we tried to follow up the Gurla glacier and the south-west face of the mountain, but after spending two nights in the open at very high altitudes, the continual exposure and want of food compelled me to give up the attempt.

During our descent of the Gurla glacier on July 25, we found that the dry glacier was too rough to follow, apparently owing to surface evaporation caused by the extreme dryness of the atmosphere. For the same cause the glacier stream itself is a very small one. A similar condition has been noted by Freshfield and Mumm on Ruwenzori. The snout of the glacier shows signs of actual recession at the present time. There were several beds of dead ice protected by moraine-stuff below the snout, and these were succeeded by typical glacial pools. Unfortunately, all the plants I collected during this excursion were lost. Of the animals, burrhel (*Ovis nahura*) ranged up to and above the snow-line. One mouse-hare (*Ochotona*, ? sp.) was seen about 17,000 feet. Woolly hares (*Lepus oiostolus*) were common on the lower slopes of the peak, where there were also a few small colonies of marmots (? sp.). On the plain, about Bal-dak (15,000 feet) were a few kiang and goa (*Gazella picticaudata*). I also saw two black wolves (Tib. *Hakpo-chanko*).

Rejoining Sherring on July 29 at the south-west corner of Mansarowar (Mo-bang), we marched the next day along the neck of land which separates this lake from that of Rakas (La-gang), and camped on the shingle beach below Jiu Gom-pa, having crossed the partially dry, but deeply cut, connecting channel at the hot springs. The east end of the channel was closed by a raised bank of shingle, apparently due to wave-action, although there are signs, especially on the low cliffs at the north-west corner, that the level of the lake has fallen in recent times. Sherring obtained an excellent panoramic photograph showing portions of both lakes and the whole length of the connecting channel; an enlargement of this is now hanging in the Society's Map Room.

I accompanied him on his road to Gartok, past the beautiful peak of Kailas, and as far as Missar, following the route recently described by Rawling, and traversed in part by Moorcroft and Hyder Hearsey in 1812. Woolly hares, mouse-hares, ground-choughs (*Podoces humilis*), a small flattish sandy-coloured lizard, and a locust (*Bryodema inda vel sp. n.*), whose appearance when flying curiously resembles that of *Vanessa antiopa*, were the commonest forms of animal life, while kyang and goa were occasionally seen. I also obtained here a pair of sand-plovers (*Ochthodromus pyrrhothorax*, Sharpe), with nestling. The plains were covered with a low growth of *dama* (*Caragana pygmœa*), which with yak droppings formed the only fuel we ever obtained in Tibet.

From Missar I turned off to Tirthapurri, on the Satlej, the ground between the two places being often completely covered with a plant indistinguishable from the *edelweiss* of the Alps. There are some hot springs of great repute at the latter place, which have formed well-defined encrusted terraces near the river. An indescribably filthy monastery, some shrines, and *mendongs* were shown me, said to be the goal of many pilgrims, both Buddhist and Hindu.

On August 7 we forded the Satlej half a mile above Tirthapurri, and, making two long and difficult marches through the almost waterless hills of Chitumb, reached Gyanema late at night on August 8. The fair was in full swing, and a great trade in wool was going on. Owing to illness, probably caused by bad water, I was confined to my tent for a week, and afterwards had to give up walking and ride a yak, so that my opportunities of examining the neighbourhood were very limited. The lake is smaller than at the time of the Stracheys' visits, and its western end is surrounded by soft mud flats, on which were a few ducks and waders. I visited what I supposed were the ruins of the "fort," on a small hill between the Tibetan and Bhotia camps, but found only some ruinous *chortens* and *mendongs*. The Tibetans were quite friendly, and supplied me with yaks to continue the journey.

Leaving Gyanema on August 18, we reached Shibchilam on August 20, the three days' march being across an almost level shingly plain covered with clumps of *dama* about a foot high. Strachey's comparison of this plain to a vast lake is singularly apt, the mirage assisting in the delusion. On the way we forded the Darma Yankti, Gan Yankti, and Chu-Naku, all rapid glacier streams with only slightly sunken beds. The former is undoubtedly, as Sir Henry Strachey suggested in 1846, the longest branch of the headwaters of the Satlej, while the three streams which combine to form the Chu-Kar must carry a greater volume of water than the Satlej where I forded it at Tirthapurri. Gurla was the most prominent object in view, but the Himalaya to the south were constantly visible. The weather was very clear and often oppressively hot, and the daily southerly wind and dust devils were trying. Each evening as the sun set, diverging rays of bright pink light shot up into the eastern sky; gradually the dark shadow of the earth—clearly visible at first, but soon becoming indistinct—crept up and blotted out this beautiful sight.

Shibchilam lies in a deep gorge on the left bank of the Tok-pu. The sections consist entirely of coarse gravel, with rounded and subangular stones embedded in it. Both Tibetans and Niti Bhotias were in camp here. The Dzong-pon of Daba paid me a visit and arranged for a relay of yaks.

On August 22 we made our last march across the plain, which is, however, deeply scored by numerous steep-sided gravelly ravines, all trending towards the Satlej. The present rainfall is obviously insufficient to have cut them out, and we have here another piece of evidence of the increasing dryness of the climate, though we had the unusual experience of a sleet-storm at starting, and flowers and grass were becoming more common amongst the everlasting *dama* as we reached the Dakkar hills. We had much trouble with the new yaks, which were constantly casting their loads and breaking away, and the day's march of about 9 miles occupied seven hours.

August 23 was spent at Dakkar to collect yaks from another herd. Now that we were actually in the hills the wind was worse than ever. Nevertheless, sulphur-yellow butterflies and the common Tibetan locust (*Bryodema inda, vel sp. n.*), with an unnamed wingless species (?near *Ataxius*), were common. I also shot one of a pair of warblers (*P. affinis*), and tried in vain to get near a dark-coloured tern that was hawking over the small stream.

Dakkar is surrounded by hills with strangely contorted pinnacles of red rock protruding from their sides. On August 24, accompanied now by only two Tibetans and two Garhwalis, we made a short march south-west into the "Red Hills," getting a view of Kamet on the way, and camped in a wild windy glen. This is a noted region for *Ovis ammon (Hodgsoni)*, but except for two skulls we saw no signs of them. On August 25 we made our last march in Tibet. Leaving our lonely camp, we continued along a narrow ravine in a south-south-west direction, and crossed a high grassy ridge at an altitude of about 17,000 feet. Below us, to the west, was spread another great plain, similar to that we had already traversed, and across which lies the route from the Niti pass to Daba. A very steep descent led down to a broad but shallow stream, here flowing west. This spot is called Sag, and here we saw the last Kyang, and also a pair of terns, which seemed strangely out of place. We turned nearly due south up a side stream, the valley getting rapidly narrower, with steep bare stony sides. On the way several beds of permanent ice (*dar*) were crossed, through one of which the yaks passed by a natural tunnel. I attribute them to avalanches of winter snow, which remain unmelted year after year, partly owing to the protection afforded by the stones and shale which cover their surface, and partly to the narrow and sunless character of the gorges in which they lie. The sky, too, is generally more cloudy and overcast here as the Himalayan chain is approached, and neither is the heat of the sun nor the dryness of the air so extreme as it is further north and east. Sir Richard Strachey has noted similar accumulations in Pangong and Rupshu (*Journal R.G.S.*, vol. 23, p. 54). After a very long march, we crossed the Shelshel pass (16,300 feet) into Garhwal and camped at Hoti, having completed a journey of about 300 miles in this interesting, if much-visited, corner of Tibet, where for six weeks we had seldom been at a lower altitude than 15,000 feet. In taking leave of Tibet, I cannot refrain from recording my appreciation of the various accounts of this region which we have received from the Stracheys. Their narratives of sixty years ago constitute a record of the country and the people which is still unsurpassed.

This small corner of Garhwal, although to the south of the true Himalayan water-parting, is still Tibetan in character, though the grass is much more luxuriant. The Shelshel pass is relatively low, and the snowy range lies still to the south and west. But the whole of the

Hoti, Laptal, and Topi-dunga valleys are cut off by the narrow and extremely difficult defile of the Girthi river, and remain uninhabited. I saw no trees until we had crossed the Chorhoti pass (18,500 feet) on August 28. Marmots, of which we shot and ate several specimens, are very numerous here. I never saw them in any other locality of Kumaon or Garhwal, though they are reported to be found as far south as Trisul.

We now followed the course of the Dhaoli river, amongst what is perhaps the wildest scenery to be met with in the Himalaya, to Tapoban. Whether one tries to enter the higher ranges by the valley of the Kali, the Gori, or the Dhaoli, geographically the three chief rivers of these mountains, a zone of profound narrow and precipitous defiles is encountered, which separates the middle ranges from the more open and gently graded upper valleys into which the glaciers discharge. But of the three, the most savage and picturesque are those defiles of the Dhaoli on either side of Malari. At Tapoban we struck up over the middle ranges to Gwaldam.

Leaving Gwaldam on September 26, we reached the foot of the Kurumtoli glacier on October 1, after five hard marches, the distance as the crow flies being less than 19 miles. Our camping-place was called Mulkhet by the Garhwalis; they apply the name Kurumtoli to a grazing-ground and glacier on the western slopes of Trisul. Nevertheless, the nomenclature of the G.T.S. must be respected.

We explored this glacier on October 2–3, believing that it would lead us to the highest peak of Trisul (23,406 feet). We found, however, that a continuous line of cliffs runs due west from A 28 (22,490 feet) to the middle peak of Trisul, and that the water-parting between the Rishi Gunga and the Pindar river is displaced about 2 miles to the north on the G.T.S. maps. The glacier which is shown flowing into the Kurumtoli from the east does not enter this valley at all, but whether it flows north into the valley of the Rishi Ganga, or south-east into the Sukeram glacier, I could not see. I trust it will be realized that I speak of the work of the Indian Survey in no critical mood. With the funds at their disposal, it has been quite impossible to survey the glacier regions with any approach to detail, and it is surprising that so great a degree of accuracy has been obtained in regions so difficult of access, and which are of no importance for political or revenue purposes.

From my kind host at Gwaldam, Mr. Robert Nash, who has been many years in Garhwal, I learnt of an old pass directly to the west of Trisul, which was many years ago frequently used. Colonel E. Smyth, who selected the late Nain Singh, C.I.E., and Kishen Singh, Rai Bahadur, for the trans-frontier survey, speaks of a pass from Ralam in Johar, into the Darma valley, which he crossed with great difficulty, and which was, according to Bhotia tradition, long ago easy of passage. I have mentioned the similar case of Traill's pass over the Pindri ridge. Such

cases may be due merely to local changes in these particular glaciers, but one cannot help remembering the evidence brought forward by Blanford, Garwood, and others to the effect that the Himalaya are still undergoing a process of elevation. Such elevation, by arresting an increasing amount of the monsoon water-vapour, would surely be at least a contributory cause in the desiccation now taking place in Central Asia, indications of which are evident even in regions so close to the Himalaya as Mansarowar.

In concluding these notes, I must express my gratitude to my two Italian companions, who served me well and uncomplainingly during a long journey, which was not without a good deal of hardship and sometimes danger, and of whose technical abilities I cannot speak too highly.

NOTES ON THE WORK OF THE FRENCH GEODETIC EXPEDITION TO MEASURE THE QUITO ARC.

In 1898 the International Geodetic Conference passed a resolution that steps should be taken to remeasure the arc of meridian at the equator, which was first measured in the eighteenth century by Bouguer, La Condamine, etc. The French representatives at this conference accepted the responsibility of undertaking this, and the duty was assigned to the geodetic section of the *Service Geographique de l'Armée*, of which General Bassot, member of the Institut, was director, Commandant Bourgeois of the Artillery being head of the geodetic section. The first detachment of geodesists, Captain Maurain of the Engineers and Captain Lacombe of the Artillery, landed at Guayaquil in 1899. They were instructed to make a general reconnaissance of the mountain chain, and prepare the way for the rest of the expedition.

In 1900 Commandant Bourgeois, accompanied by Captain Lallemand and Lieut. Perrier, both of the Artillery, with the physician attached to the expedition, Dr. Rivet, *médecin aide major*, arrived at Guayquil. They at once proceeded to measure a base at Riobamba, and to determine the difference in longitude between Quito and Riobamba.

The arc measured in the eighteenth century was only 3° long. It was decided to double this length by prolonging the measurements northwards as far as the Colombian frontier, and southwards into Peru as far as the environs of Piura. The work in Equador was carried on during 1900, 1901, 1902, 1903, and 1904, first under the direction of Captain Maurain (Commandant Bourgeois having returned to France after a stay of about six months in the field), and then of Captain Massenet, who died at Cuenca in September, 1905.

In 1902 Captain Maurain went to Payta to study the terminal part of the chain of triangulation, built an observatory, and then determined its astronomical latitude. In 1905 Captains Peyronnel and Lallemand,

of the Artillery, arrived in Peruvian territory, and fixed the positions of the last stations of the triangulation and of the base of verification. In November, 1905, Commandant de Foulongue was appointed to take charge of the final operations. Accompanied by Captain Durand of the Artillery, he arrived in Piura at the end of December, 1905. In February, 1906, the measurement of the angles of the triangulation was completed, and the base measured on the *tablazo* about 4 kilometres south of Huaca.

After three measurements with Jäderin's system of two-coupled wires (invar metal), the whole length was measured once again with monometallic rods (also of invar), and then half of it was measured a second time with these rods. Precise levelling from the end west of La Buse to the station at Arenal, thence to Payta along the railway, connected the base with the tide-gauge at the customs jetty at the port of Payta, thence to the observatory.

Finally, Commandant Foulongue, assisted by Captain Noirel, who was at the observatory at Cuenca in Equador, determined the difference in longitude between Cuenca and Payta, which was thus connected with the longitude of Quito. This operation presented great difficulties owing to the mediocre quality of the telegraph lines, which had to be used for a distance of about 900 kilometres, both in Peru and in Equador. At the same time the astronomical azimuth of the last side of the triangulation (Payta observatory to Cerro de Chacan) was determined.

In Equador the chain of triangles runs above the inter-Andine valley, the stations being fixed on the two parallel mountain ranges. In Peruvian territory it was necessary to bend it towards the west, so as to arrive at the base by smaller and smaller triangles. But from Erco los Pozos it will be easy to pick the high Peruvian summits up very quickly, and to extend the arc along the Cordilleras right through Peru. The expedition was everywhere most sympathetically welcomed by the chief Peruvian authorities, who rendered it most valuable assistance.

COMMERCIAL MISSION TO SOUTH-EASTERN PERSIA.*

Mr. A. H. Gleadowe-Newcomen, F.R.G.S., F.S.A., president of the above mission, has, in a recent report addressed to the Government of India and the Committees of the Upper India Chamber of Commerce, Cawnpore, and the Indian Tea Cess, Calcutta, described the journey and experience of his mission through South-Eastern Persia, and recorded the present position and prospects of trade in that country. His report forms an interesting and valuable contribution to our knowledge of South-Eastern Persia.

* 'Report on the British Indian Commercial Mission to South-Eastern Persia during 1904–1905.' By A. H. Gleadowe-Newcomen, F.R.G.S., F.S.A., President. Published by the Government of India Printing Press. Calcutta: 1906.

The inception of this mission was due to the omission of Yezd and South-Eastern Persia from the scope of the inquiry into the state of British trade in Persia entrusted in 1903 to Mr. Maclean, the special commissioner appointed by the Commercial Intelligence Committee. On this omission being brought to the notice of Lord Curzon by H.B. Majesty's consul in Kerman, Major P. M. Sykes, D.S.O., the Government of India took up the matter, and invited all the chambers of commerce to assist and co-operate in sending a mission of a purely commercial character to that country. The only effective response made to this invitation was from the Upper India Chamber of Commerce and the Indian Tea Cess. Committee; with their assistance a mission, consisting of Mr. A. H. Gleadowe-Newcomen as president and Messrs. B. E. Luffman and P. F. Ryan as members, was appointed to proceed to Persia with the following objects:—

(1) To investigate the present state of trade in South-Eastern Persia.

(2) To examine the various causes which have tended, or now tend, to promote a natural and reasonable expansion of trade, especially with India, or the reasons of any shrinkage of the same.

(3) To consider measures to bring about an expansion of Indo-Persian trade.

(4) To introduce to Persians (traders, officials, and others) Indian manufactures, and explain the interest taken by the Government of India in fostering Indo-European trade and improving mutually beneficial relations.

(5) To collect statistics.

The mission left Bombay on October 13, 1904, and, after a short visit to Muskat, landed in Persia at Bundar Abbas on October 21. Here they were subjected to considerable annoyance by the Belgian director of customs, who, although he had received orders to treat the mission with every consideration and admit its baggage duty-free, attempted for several days to enforce upon them regulations and restrictions of an unnecessary and annoying character, even going so far as to disarm the Persian guard which had been placed at their service as escort.

This incident, the only occasion on which the mission met with anything but politeness and assistance from officials in Persia, has drawn from Mr. Gleadowe-Newcomen the following remarks:—

"I mention these details partly to show that there is more than a little truth in the complaint constantly heard from Indian subjects and from Persian traders alike that the (Belgian) customs authorities often cause them quite needless trouble, and that they are specially addicted to placing unauthorized restrictions in the way of British and Indian trade. If we, who had been granted special facilities from Teheran, suffered as we did from the vagaries of the customs official at the port, it is obvious that others not similarly situated must suffer more."

The mission, after some unnecessary delay due to the above causes, left Bundar Abbas on November 7 and marched to Saiadabad in Sirjan, thence to Bahramabad in Rafsinjan, and Kerman. From Kerman a tour was made through Bam and the Narmashir district to Ramrud, and back to Kerman by the Jiruft valley. Starting again from Kerman the mission marched *viâ* Yezd and Shiraz to Bushire, whence they returned by steamer to Bombay.

It will thus be seen that the mission made a comprehensive tour of South-Eastern Persia, and their long land-journey of 1790 miles included a visit to all the leading trade centres of that portion of Persia.

Mr. Gleadowe-Newcomen has much pleasure in recording that throughout this long journey, "in the course of which we met practically every individual of importance, British prestige and influence showed itself on the whole not only to be predominant, but a real power for good in the land—a fact which argues well for the future of Indo-Persian commercial relations."

The report gives an admirably complete account of the present conditions of trade in South-Eastern Persia, the difficulties and restrictions under which it is now carried on, and the possibilities of its future development and expansion. It furnishes in the form of carefully prepared appendices a large mass of statistics, which afford much interesting and valuable information.

Space does not admit of a detailed reference to the present conditions, capabilities, and requirements of the many trading centres described in this report, such as Bundar Abbas, Saiadabad, Bahramabad, Kerman, Khabis, Gok, Bam, Jiruft, Rodbar, Yezd, Shiraz, and Bushire; but the interest of the subject demands a brief mention of the comparative merits of the two chief ports in the Persian gulf, by which trade with those places is carried on. Of these two ports, Bushire and Bundar Abbas, the former at present practically monopolizes the sea-borne trade of Southern Persia. Why this should be so is very curious. It possesses every disadvantage that a port can possibly suffer from, and no attempt has yet been made to improve it. As Mr. Gleadowe-Newcomen truly says, "Bushire as a port is as inconvenient as ever it was. Cut off from the interior by a wall of mountains, it is separated from, rather than connected with, Shiraz by what is perhaps the worst road in the world. The only hospitality that the premier port of the Persian Empire has to offer ocean-going craft is that of an open roadstead, separated from the town by 3 miles of flats and shoals, and an outer roadstead, 7 miles from shore, where ships of any considerable draught or which have been delayed by accidents of wind and tide have to anchor. The place is liable to be visited by sudden snowstorms, which make the working of cargo hazardous and often impossible, and sometimes oblige ships to put out to sea to avoid being driven ashore."

By dredging a passage through the bar it would not, it is said, be "a difficult or unduly expensive feat to make Bushire into a fair harbour." At present "the unfortunate skipper has to risk two transhipments—one between the ship and the Bushire Customs Wharf, and the other between Bushire and Shief. At Shief, goods coming downwards lie on the beach exposed to the weather, awaiting, often for weeks, the pleasure of highly independent and inefficient boatmen, who, when they do take the cargo, cause infinite damage, and not seldom broach or jettison cargo confided to their charge."

As if this state of affairs were not sufficiently bad to discourage trade with Bushire, the Belgian Customs Department, by a hundred petty but harassing and inconvenient regulations, totally unsuited to local conditions and requirements, have done all they can to make trade *viâ* Bushire still more difficult and unprofitable.

On the other hand, "Bundar Abbas is the best and most conveniently situated port on the gulf, with the exception of Ahwaz, over which it has the advantage of a shorter sea-beach. It is the natural southern outlet of and entrance for the trade, not only of South-Eastern Persia, but of the whole of the immense tract of country lying between Herat and Yezd, Mishid, and Bampur. . . . There is a fairly good roadstead, which could be made into a really good harbour by dredging and the building of a mole, so as to allow of ships riding at anchor well inshore, secure from the surf set up by the south-east wind, and a pier where goods could be landed with expedition and safety."

At present the insecurity of the roads leading into the interior, owing to defective provincial administration, prevents the natural advantages of Bundar Abbas being as much made use of as they might be.

A few extracts from the able *resumé* which concludes the report under review will suffice to show the present position and requirements of British trade in South-Eastern Persia. That trade is not in as healthy a condition as could be desired. It

has been stagnant for five years, and now shows a slight decrease. Unless special efforts are made it will continue to make no progress.

"According to the statistics issued by the Belgian-Persian Customs Administration, the entire foreign trade of Persia for the year March, 1903, to March, 1904, amounted to £10,661,695—*i.e.* imports, £6,415,609; exports, £4,246,086. Of this, the lion's share is Russian, amounting to a total value of £5,668,340, of which £3,077,636 represent imports and £2,590,740 exports. The British Empire's share is £2,490,009, of which £2,138,112 represent imports and only £351,897 exports." . . .

The position, however, of the trade of the British Empire with Persia is, Mr. Gleadowe-Newcomen informs us, not so bad as it appears at first sight. In the first place, some of the falling-off "is more apparent than real, for a large proportion of the Indian tea-trade, that used to find its way into Khorassan and through Persia into Russian territory, now goes *viâ* Batum. This decreases the volume of British trade with Persia and, at the same time, increases that of Russia.

Russian trade with Persia is facilitated by the comparatively easy means of communication with Persia on the north; by the fact that the boundaries of the two countries reach along the whole extent of the northern frontier of Persia; that the population on both sides is nearly industrial in so far as wants and habits are concerned; that the richest parts of Persia are on the north; and that Russian trade is carefully nursed and bolstered up by artificial aids. No wonder, then, that Russian trade advances so rapidly.

On the other hand, British trade with Persia is heavily handicapped. The major portion enters Persia through the Gulf ports under great difficulties in landing and inland transit. Southern Persia is poor and undeveloped, and communications are insecure. British trade is not assisted by the British Government in any way, financial or otherwise, and British consuls do not always take that interest in developing commerce that Russian consuls invariably do.

Mr. Gleadowe-Newcomen finally concludes his report by enumerating the various measures necessary for developing British trade. These measures need not be quoted here in detail. They are deserving of careful consideration. They are aimed at removing or minimizing the difficulties and disadvantages by which our trade is at present handicapped. These fall under four main heads—

1. A customs tariff hostile to ourselves in its conception and provisions, and worked under a reglement which is "impractical and unjust in its terms, being utterly unsuited to the commercial, physical, and geographical conditions of the country." The tariff cannot be altered for years to come, but the reglement is subject to and imperatively needs revision.

2. The physical difficulties of the country. These can be removed by improved communications inland and by harbour construction at the Gulf ports.

3. The want of a stronger line of British policy at Teheran, and absence of proper appreciation of commercial interests and needs at our consulates.

4. The want of proper combination and initial effort among British and Indian firms trading with Persia.

Mr. Gleadowe-Newcomen has not hesitated to state the conclusions arrived at by himself and his mission with candour and boldness. His arguments appear to fully justify those conclusions, and the remedies he proposes seem reasonable and practicable.

The report is one of great interest and importance, deserving of careful perusal and consideration by all interested in the position of British trade and influence in Southern Persia.

REVIEWS.

ASIA.

India.

'India.' By Pierre Loti. Translated by G. A. F. Inman. London: T. Werner Laurie. (Undated [1906].) *Price* 10*s*. 6*d*. *net*.

The poetic fancy which is common to French descriptive writing and tempers scientific geographical work in that language, is as fully developed as would be expected in this book by M. Loti. But, in truth, his 'India' is difficult to consider as a geographical work. Certainly, he paints in broad colours those parts of India through which he travelled, but generally as no more than a background to his own strongly individual impressions. It is not to be supposed, however, that these impressions are without interest; they are full of it, and where the topographical background is necessary, there it is vividly portrayed. In this way, though the geographical result is fragmentary, not a few clear pictures stand out. Such are those of the environment of the "buried city" Anuradhapura, in Ceylon ("the damp green island," as the author terms it); of the journey thence to Trivandrum, where M. Loti was to present a French decoration to the Maharajah of Travancore; of the passage by the lagoons to Trichur; of Pondicherry, Hyderabad, Gwalior, and, among others, of Benares, where, as elsewhere, the author was specially attracted by the temples, religious ceremonies, and beliefs. Throughout, the author deals strictly with native life in India "without the British." The translation is generally excellent, though it must needs be occasionally felt to labour somewhat heavily in the wake of the original.

Siam.

'Lotus Land: an Account of the Country and the People of Southern Siam.' By P. A. Thompson. London: T. Werner Laurie. 1906. *With a Map. Price* 16*s*. *net*.

This book will form a useful work of easy reference on certain aspects of the country with which it deals. The author is concerned mainly "to give a faithful account of the peasantry, amongst whom I lived for three years." In a long and excellent introduction, with copious reference to Aymonier and other authorities—a valuable feature—he prepares the reader by touching briefly on the physical character of the land in connection with human settlement, and also goes into the diverse origin of the various peoples who dwell or have dwelt there. After a description of Bangkok, the bulk of the work is taken up with an account of the present inhabitants of the country. Their religion, traditions, folklore, customs, art, etc., are detailed. Good and apposite illustrations, from photographs or drawings, accompany each section, the most striking being, perhaps, those of architectural details in some of the splendid ancient temples. There is a large map of a most elementary character, which could have been a quarter its actual size and still serve its simple purpose.

AFRICA.

Portuguese East Africa.

'Portuguese East Africa. The History, Scenery, and Great Game of Manica and Sofala.' By R. C. F. Maugham. *With Map and Illustrations*. London: John Murray. 1906. *Price* 15*s*. *net*.

Mr. Maugham is British consul for Mozambique, and writes with the authority derived from several years' acquaintance with South-East Africa. His subject is not so wide as the main title of the book indicates; his narrative—the historical chapters apart—is practically confined to the territory of Manica and Sofala, *i.e.* the region

between the Zambezi and Sabi rivers. Of this region he gives, not geographical details, but vivid pen-pictures of coast and river, mountain and plain. An instructive chapter on flora and fauna is succeeded by several chapters on big-game shooting. These should not be passed over lightly by the non-sportsman; they are not mere hunting yarns, but contain much valuable zoological information. Two chapters are given to ethnology, and one, full of useful hints, to climate and health. The part of the book most open to criticism is that devoted to history. So far as the story of the Portuguese in East Africa is concerned, it need only be said that the narrative might be clearer and fuller. Mr. Maugham is, apparently, unacquainted with Theal's 'Records of South-East Africa,' the one great collection of original documents dealing with the country. It is in his references to pre-Portuguese days that the author is least trustworthy. He makes no reference to Dr. Randall-MacIver's excavations in Rhodesia. On the contrary, having stated that the ruins of the Zimbabwe near Victoria are considered by distinguished authorities to mark the spot upon which "the city of Ophir" was built, he adds, "The question in vain presents itself, at what period of the world's history were these imposing edifices erected?" A little later the author writes of the Portuguese (*c.* 1600) making a serious mistake in "abandoning" the Cape of Good Hope; which is, at the least, a misleading statement. In a brief sketch of the existing method of government in the region in which he is consul, Mr. Maugham states that there is no language-test for the executive officials. "In the great Portuguese East African province . . . few are the administrative officials possessing even a rudimentary acquaintance with the languages of the large number of natives whose interests they are believed to study, and whose disputes they are appointed to settle." This fact accounts for a great deal that is unsatisfactory in the condition of the province. Though Mr. Maugham applauds the "proper and practical" view of the Portuguese in regarding the negro as a manual labourer and nothing more, and is strong in denunciation of the mission native, he yet recognizes, with some confusion of mind, that the day of intellectual awakening of the native is coming. The book has some excellent photographs, and is a welcome addition to the literature of a little-known region.

F. R. C.

AMERICA.

Colombia.

'The Republic of Colombia.' By F. Loraine Petre. London: Stanford. 1906. *With a Map.*

Mr. Petre hopes that it may be found "useful to have, in a convenient form hitherto not available in English, some general information" regarding Colombia. It must needs be so, for this is a country whose character, capacities, and institutions are but little known, whereas this type of general descriptive work, which is not too common in English, is of no small value, even on familiar ground, when as well carried out as in the present case. The book is no doubt written primarily for those who have or seek financial interests in Colombia; but it will serve as a first lesson to the student of the country in almost any aspect. Mr. Petre deals successively with physical features; with the curious journey by steamer on the Magdalena, rail, and most primitive road from Cartagena to Bogota; with the capital itself; with the people, their history and government, the natural resources of their country, and their prospects. Mr. Petre's own travels in Colombia have not broken fresh ground, so it is not as an explorer that he appears in this work, though he gives some indication of the work of others. The book is successfully illustrated with photographs, and has a map on a scale of about 1 : 5,000,000, fairly satisfactory, but not perfectly in agreement with the text in some matters of detail.

Economics of South America.

'Panama to Patagonia.' By Charles M. Pepper. London: Hodder & Stoughton, 1906. Size 9 × 6, pp. xx + 398. *Map and Illustrations. Price 10s. 6d. net.*

The commercial relations of South America will undergo certain changes by the construction and opening of the Panama canal. In 1905 the author visited the Western Republics, and his book describes the country traversed; but his chief object is to describe the present, and speculate on the future, economic and industrial development of the republics of Ecuador, Peru, Bolivia, and Chile. The point of view is that of the United States, which country, by its control of the canal, will benefit materially by the shortening of its sea route to the west coast of South America.

The author claims that not only will most of the trade of the west coast, which at present goes by way of the Magellan straits, go through the canal, but that, by the series of railways across the Andes now under construction or in contemplation, some of the rubber of the Amazon, wheat of Argentina, and minerals of Bolivia, which at present flow to the Atlantic, will be captured for the Pacific and Panama route, but—we shall see. The trade of the headwaters of the Amazon may be interfered with, but it is questionable whether much will travel upstream. As regards the Argentina wheat—why should it cross the Andes? for what market?

There are full statistics. Products, shipping tonnages, populations, distances between ports, and the saving of mileage and time between the United States ports and those of South America due to the canal, all are given. Discomforts and incidents of travel, the manners and customs of the people, are noted. Climates are discussed and temperatures given. There is a chapter on the nitrate deposits of Peru, and another on Chilean social questions in which an amusing tale of the ballot-box is related. In the chapter discussing the Munro doctrine and its application to South America, comparisons are drawn between the "blundering, even stupid" English policy of investments and that of the "timid, over-cautious" Germans, and the author thinks that probably the English have been paid greater dividends "in proportion to the capital."

The book is well illustrated, there being fifty photographs depicting harbours, towns, industries, and native life. There are four very indifferent maps: on one it is allowed that the "boundaries between countries are indicated only approximately," reference notes are omitted from that of the Panama canal, while there is no scale on the other two.

W. B.

GENERAL.

The Founder of Physical Geography.

'Klassiker der Naturwissenschaften herausgegeben von Lothar Brieger-Wasservogel.' IV. Band. Varenius. Von Prof. Dr. S. Günther. Leipzig. [1906]. Verlag von Theod. Thomas.

Probably less is known of Varenius than of any of the early geographers whose books have been landmarks in the history of science, and Prof. Günther has performed a grateful service in piecing together the scattered references to a life which was in truth itself but the fragment of a life, breaking off at the moment when the masterly 'Geographia Generalis' gave promise of a brilliant future. This memoir devotes six chapters to facts about Varenius, the bibliography of his great book and the opinions of later generations upon it, and then seven chapters to the book itself, summarizing the argument and throwing much light upon the state of contemporary geographical knowledge. The text occupies 125 pages; the notes which follow, 644

in number, fill 87 pages more, and these of smaller type, constituting, we cannot but suppose, a bibliography as nearly exhaustive as diligence and learning can produce.

Bernhard Varen (whose name is universally known in the Latin form Varenius) was a German, born at Herford in Westphalia in 1621 or 1622. He studied at Hamburg under Jungius, an enlightened and progressive teacher, and passed thence to the University of Königsberg, where the studies were bounded by the writings of Aristotle, and mathematics taught in its applications to three subjects of modern interest—geography, astrology, and fortification. He studied mathematics from inclination and medicine as a duty; moved to Holland, where he lived for some time by private teaching, and, in 1649, graduated as a doctor of medicine at Leyden. But mathematics and its applications held his heart, and instead of medical practice he took to literary work for the famous firm of Elzevir, for whom he compiled a little book on Japan in 1649 for a series of geographical studies; and, in 1650, for the same firm, he produced his 'Geographia Generalis,' a single small volume in Latin. From this point nothing further is known of Varenius; he vanishes, and is presumed to have died in that year; but the book lived. After three editions of the Latin text had appeared in Holland, Sir Isaac Newton produced a revised edition at Cambridge, with the addition of diagrams, in 1672. Nearly a hundred years later the Latin text was translated into English, Dutch, and French, and it is not too much to say that the book remained the best text-book of geography for a century and a half.

In a series of chapters dealing in turn with the introductory, mathematical cartographical, nautical, meteorological, oceanographical, and geomorphological sections of the 'Geographia Generalis,' Prof. Günther shows how in each Varenius had grasped the correct guiding principles and laid down in his terse Latin sentences the main lines of the future development of the science, and justified Prof. Hermann Wagner's dictum that "Varenius is the founder of physical geography."

H. R. M.

WATER CARRIAGE.

'Our Waterways.' By Urquhart A. Forbes and W. H. R. Ashford. London: Murray. 1906.

'British Canals. Is their Resuscitation Practicable?' By Edwin A. Pratt. London: Murray. 1906.

'Ocean and Inland Water Transportation.' By Emory R. Johnson. London: Appleton. 1906.

Of the three books noted above, all dealing at least in part with a subject which is now engaging a good deal of public attention, that of inland waterways, the first two are more or less controversial, the one favouring, the other contesting the practicability of reinvigorating the inland water traffic of this country. The sub-title of the book by Forbes and Ashford describes it as 'A History of Inland Navigation considered as a Branch of Water Conservancy,' and as a history it contains much of great interest, including much of special geographical interest, more particularly in the chapters treating of the conservancy of rivers in England and Wales, both before and subsequent to the canal era; and the value of the work, both from a geographical and historical point of view, is enhanced by the appendixes giving various figures relating to the rivers and lakes of the British Isles, an alphabetical list of the canals and river navigations of the United Kingdom, distinguishing the length under railway control and that of the independent waterways, another alphabetical list of the navigations that have become derelict or got converted into railways, a chronological list of statutes, charters, grants and letters patent referred to in the work from 1225, a note on commissioners of sewers, and a list, in chronological order (from 1655), of authorities cited.

But though the sub-title of the book describes it as a history, the last chapter in it is expressly devoted to the discussion of the question of the resuscitation of our waterways, and there are many incidental observations in other parts of the book bearing on the same questions. The bias of the authors is in favour of resuscitation, and is so strong that, with every attempt to be fair, they are sometimes betrayed into the use of expressions difficult to reconcile with their candid statements of fact elsewhere. In their history of the extensive purchases of canals by railway companies (pp. 224-6), they admit that in many cases this was done by the railways under pressure in the manner more fully set forth by Mr. Pratt ('British Canals,' p. 36 onwards). They point quite justly (p. 223) to the large amount of traffic still carried by English waterways in spite of "the vastly superior facilities provided by railways;" yet they regret (pp. 228–9) that railway companies were not compelled to purchase the canals at "fair prices" (evidently something different from the prices which the canal companies were able to get and willing to take) or else prohibited from purchasing the canals, so that the traffic of the country might pass into "the more convenient and commercial channel," by which apparently is meant that of the waterways. But if railways provide "vastly superior facilities," where is the greater convenience and superior commercial character of the other mode of transport? Mr. Pratt (pp. 110-11) tells us that Mr. Carnegie, who in his 'Triumphant Democracy' has sufficiently emphasized the importance of inland waterways in the development of the United States, declared to the Pittsburg Chamber of Commerce in 1898 "that if we had a canal to-day from Lake Erie . . . to Beaver [the point on the Ohio River nearest to the lake] free of toll, we could not afford to put boats on it," and Mr. Carnegie is generally understood to be pretty well able to form a correct judgment on the commercial value of different modes of transport. Again, the admission of the fact of the large amount of traffic still carried by our waterways does not prevent Messrs. Forbes and Ashford from speaking of the English railway companies as having acquired "a virtual monopoly of the internal transport of the country" (p. 229).

The passages already quoted are taken from a chapter that is professedly merely historical. When the authors go on to discuss expressly the question of the practicability for reviving our inland waterways, it cannot be encouraging to those who hold the same view to find that their arguments are mainly based on very general considerations. "An additional proof," we are told (p. 264), "of the value of inland water-transport is to be found in the results that have attended its development in the United States and on the Continent;" and on the same page we are told that 27 per cent. of the [internal] traffic of the United States is water-borne. Now, that is true. From p. 370 of Prof. Johnson's 'Ocean and Inland Water Transportation' (a work which, it may be noted, though bearing on its title-page only the name of a London publisher, is really an American book by the Professor of Transportation and Commerce in the University of Pennsylvania) we learn that the proportion of lake-borne traffic in the United States in 1904 was about 30 per cent. of that carried by rail; but when it is considered that this lake traffic, carried on under conditions corresponding to those of the coasting traffic of our own country, has to be taken into account in order to make good the statement of the authors of 'Our Waterways,' and that, as Prof. Johnson tells us, "the traffic on the Mississippi river and on some of its tributaries, with the exception of the Ohio, is either stationary or declining" (p. 371), one is apt to conclude that in appealing to the experience of the United States as a "proof," the authors are hard pressed for an argument.

The mode of stating the case adopted by Mr. Pratt is altogether different from that followed by the authors of 'Our Waterways.' He comes into close grips with

the subject, sets forth the nature and geographical distribution of commodities which are suited for water-traffic, compares the geographical conditions favouring the use of natural waterways and the construction of adequate artificial waterways in other countries with those at home, is concrete and definite instead of vague and general, so that even those who take a more favourable view than he does of the possibilities of English waterways, are likely to find his 'British Canals' a more illuminating book than 'Our Waterways.'

As the title indicates, Prof. Johnson's work is of wider scope than either of the two others. It covers, to a large extent, the same ground as Dr. Russell Smith's 'Organization of Ocean Commerce,' reviewed in the *Geographical Journal*, vol. **26**, p. 552, and to this work, as well as its author (a colleague of Prof. Johnson's), there are many acknowledgments of indebtedness in this book. So far as the two works correspond, that of Prof. Johnson differs from Dr. Russell Smith's monograph in containing numerous illustrations, nearly all very instructive, and more references to other authorities, and the inclusion of some subjects not dealt with by Dr. Russell Smith or the fuller treatment of subjects only cursorily noticed by him. Among these subjects are the Passenger Service, the Ocean Mail Service, the International Express Service, the Co-operation and Combination of Ocean and Rail Carriers, to each of which a chapter is devoted, and Government Aid to National Shipping, which is considered in more than one chapter. Every subject taken up is treated with admirable lucidity and judgment.

A remark may be made on one view shared by Prof. Johnson and Dr. Russell Smith, the influence of the causes that aid the development of line traffic in narrowing the sphere of the sailing vessel. Neither of them, indeed, ventures to predict the extinction of the commercial sailer, and when we consider the number of sailers that are still getting built, and that it is not merely steamers that are being built of larger and larger dimensions, that would be a hazardous prediction; but they both point out that one of the functions of the sailer is to carry on the irregular work of international trade, and that irregular work is in many cases likely to grow into regular and continuous work, which is most economically discharged by lines of steamers. No doubt that is true; but it must be borne in mind that very much of this irregularity is due to seasonal fluctuations over which man has no control. Consider, for example, the enormous variations from year to year in the quantity of such bulky produce as wheat and grain that has to be transported from different parts of the world. In the ten years 1891 to 1900 the total quantity of wheat and flour imported into this country varied from about 4 to 5 million tons, a variation of about 25 per cent. of the smaller and 20 per cent. of the larger figure; but of the total upwards of 1,200,000 tons came from the Black sea ports in each of the years 1895 and 1896, but less than 200,000 tons in each of the years 1898–1900. From the river Plate upwards of 500,000 tons were derived in 1894, 1895, 1899, and 1900, but in 1897 little more than 50,000 tons; from the Atlantic ports of North America in 1895 little more than 1,500,000 tons, but in 1892, 1898, and 1899 more than 2,500,000 tons. Such fluctuations make it clear that a great deal of traffic must still be left for the tramp, including the tramp sailer. It may indeed be contended that in the fûture, as population condenses in new countries, such fluctuations may be restricted through the growing requirements of the populations of the grain-producing countries. That may be so, but if so, it is more than the sailing-vessel that will be affected thereby. The world will then have entered on a new phase of its economic history.

G. G. C.

THE MONTHLY RECORD.

EUROPE.

Rainfall of Two English Counties.—The lately issued Geological Survey Memoirs on the Water Supply of Suffolk and the East Riding contain notes on the rainfall, by Dr. H. R. Mill, based on thirty-five years' observations brought together by the British Rainfall Organization. The period over which the observations extend is long enough, Dr. Mill points out, to justify the belief that the averages obtained (after making certain necessary corrections) will correspond, within about 2 per cent., with those of a very much longer period. A map is given in each case showing the distribution of the rainfall over the county, though in the case of Suffolk the variation from point to point is but slight. Thus the means in the case of the whole areas with a fall below or above 25 inches differ only by 1 inch (24·3 and 25·3 inches). It may be noted, however, that the high ground of the East Anglian ridge, formed by the chalk on the west and the strip of country just within the coast-line on the east, has a slightly heavier rainfall than the river-valleys or the central portion of the plain. In the East Riding the variations are much greater, the fall rising from less than 25 inches in the flat grounds to the south-east to over 32·5 inches in the high land to the north-west. Dr. Mill also discusses the seasonal incidence of the rainfall, an important consideration from the fact that it is only the fall during the six winter months that has any appreciable effect in replenishing the underground supply. In the case of Suffolk, the wettest months are October and November, and the driest April and February; though heavy falls are occasioned by thunderstorms in the summer months. These, in the East Riding, bring up the average for August to the second place on the list, October still showing the maximum. Here the half-year, October–March, during which percolation is at a maximum, has scarcely more rain than the April–September half, in which it is at a minimum.

Limnological Station in Austria.—Thanks to the impulse given to biological science in the last decades, three large zoological stations have been founded at Naples, in Heligoland, and at Trieste for the study of sea-fauna. Among the stations devoted to the investigation of the animals of fresh-water lakes is one at Plön, in Holstein, now for some years under the care of Dr. Otto Zacharias. In Austria, too, a similar limnological station has recently been erected as a permanent laboratory; and the management of it has been committed to Prof. Dr. R. Woltereck, of Leipzig. There were before, indeed, similar establishments in Austria, namely, in Bohemia, for the study of its waters. These, however, were no permanent institutions. The new limnological station is situated at Schloss Seehof (2034 feet above sea-level), near Lunz, in the south-western part of Lower Austria. Lakes, ponds, watercourses, as also a fish-breeding aquarium in the district, are placed at the free disposal of the station. The three lakes belong to the *massif* of the "Dürnstein" (6158 feet), a neighbour of the much-climbed "Oetscher" (6208 feet). They belong to the headwaters of the Ybbs, a tributary on the right bank of the Danube. The region is noted and much visited for the unique beauty of its mountain framework and its rich narcissus flora in spring. The conformation of the environment indicates distinctly the glacial origin of the lakes, as demonstrated by Richard Michael in the eighties, while their situation on three terraces of the valley and in the shadow of high rock walls, gives an opportunity for the study of the influence of differences of altitude, of mountain shadows, and of other climatic-orographical factors. The upper lake lies at the bottom of a cirque at an altitude of 3862 feet. Its investigation will, therefore, yield interesting comparisons,

e.g., with the "Grosser" and "Kleiner Teich" in the Riesengebirge, made known by the researches of Zacharias. They lie at about the same altitude above the sea as the upper lake, but three degrees farther north, sunk between rock walls. Thence the Hirschbachtal descends towards the north in several steps. From one of them plunges Ludwigsfall, 197 feet high. On another lies the small Mittersee, at a height of 2517 feet. On the terrace before the narrow outlet of the valley lies the outer Zunzer See, 2024 feet above sea-level. It is 1 mile long by about one-third of a mile average breadth, and was found by Michael to be 112 feet deep. Hydrographically one, the three lakes yet present biologically the greatest and most essential differences. The upper lake contains genera and species completely wanting in the other lakes, and *vice versâ*, while within the same genus, characteristically different subspecies in the different lakes are found. These peculiarities, together with the great wealth in them of living organisms, render the lakes in a high degree adapted for biological research. The institute has five large working-rooms, furnished with all necessary instruments and utensils, a good departmental library, photographic apparatus, large aquariums, and ample grounds for making experiments on a large scale in the open. Hydrographical and biological work has already been begun. The staff includes, besides the director, the zoologist Dr. Franz Küpelwieser, junior, and as permanent assistant, Dr. F. Ruttner, of Prague. The institute is to be open for biological research to scientific men, native and foreign. Inquiries are to be addressed to the Director of the Biological Station, Lunz, Lower Austria.

ASIA.

Return of Dr. Zugmayer.—This Austrian traveller, whose expedition to Tibet was alluded to in the January number (p. 87), has now returned to Europe, having landed at Trieste on December 18, and at once proceeded to Vienna. He had reached Leh early in October, having been forced, by severe losses among his baggage animals, to considerably curtail his original plans, which had embraced a possible visit to Lhasa. Writing from Leh to Mr. Macartney, the British agent in Chinese Turkestan, he gave some details of his experiences. After first setting out from Polu, towards Lake Markham, and passing somewhat beyond the limits of surveyed country, he had been forced to return to the upper Keriya darya, and leave there a good deal of his baggage. He then made his way *viâ* Yeshil kul to Arport Tso, but, failing to obtain the required number of yaks, found himself compelled to take a south-westerly route instead of one to the south-east. A subsequent attempt to go east was frustrated by the opposition of the Rudok officials, who threatened to stop the traveller by armed force, and he therefore made his way to Leh by a route north of the Pangong lake. He expressed himself well pleased with the zoological results of his journey.

M. Pelliot in Central Asia.—A communication from M. Pelliot (*Journal*, vol. 27, p. 87, and *ante*, p. 87), printed in the December number of the *Bulletin du Comité de l'Asie Française*, reports on the work done by the expedition down to October last, and, though not giving news of any striking discoveries, supplies an interesting appreciation of the existing state of affairs in Central Asia. While Russian Turkestan showed many traces of ferment induced by recent political events in the Far East, the indolence and apathy of the people of Chinese Turkestan —a result of the comparative ease with which their necessities are supplied by the aid of irrigation—renders them indifferent to external movements. M. Pelliot lays stress on the fact (which he himself did not at first sufficiently realize) that the basis of the population is Iranian rather than Turkish. He discusses the economic relations of the country, and shows that, although Russian trade has greatly fallen

off since the war, the geographical obstacles to easy communication with India must eventually give the commercial victory to Russia, though a readjustment of the routes of access must come about in the future with the opening of the projected railway to Semirechensk, which will give a decided preponderance to the Narym route. The work of the expedition had so far consisted in the collection of data for the chronology of the country in the Buddhist era and in the early days of Islam, and in the correction of minor details in the geography of the country traversed.

Archæological Discoveries near Turfan.—We alluded some time back (vol. **27**, p. 303) to the archæological expedition to Central Asia undertaken by Dr. von Lecoq. This traveller has for the past two years been carrying out excavations near Turfan, and some account of the results, which are of considerable interest, has been communicated to the *Times* of India by its special correspondent, who met Dr. von Lecoq at Srinagar on his return from his expedition. The traveller, who is of Huguenot descent, had made previous archæological discoveries in the vicinity of Aleppo, where he unearthed the ruins of an Aramaic city. For some months the investigations at Turfan were without fruit. But then Dr. von Lecoq's assistant, Bartus, stumbled on what is called a "noble treasure trove," consisting of wall pictures or frescoes and a host of manuscripts in ten different languages, viz. Nagari, Central Asian Brahmi, Tibetan, Chinese, Tangut, Syriac, an unknown tongue (a curious and undeciphered variation of Syriac), Manichæan, Uighur, and primitive Turkish. The latter has an alphabet much like the Runes, which are the letters of the old Norse language. Most of the manuscripts are on paper, some on soft and carefully dressed white leather, and some on wood. There were numerous evidences of Iranian inhabitants and influences in these parts, and also gruesome evidence of the persecution of Buddhism by the Chinese many hundreds of years ago in the shape of the packed bodies "clad and odorous" of a multitude of Buddhist monks who had been immured alive in the dungeon of a temple. The wall paintings on plaster are Buddhistic, and are supposed to indicate the missing stepping-stone by which Indian art advanced across Asia to Japan. Dr. von Lecoq has now returned to Germany, leaving his researches and excavations to be carried on by his former chief, Prof. Grunwedel. The amount of manuscript records and antiquarian remains sent home by Dr. von Lecoq must be enormous, thirty cases having been brought by him personally over the Himalayan mountains, and two hundred cases having been sent home *viâ* Russia. It is pronounced to be the biggest material haul made in antiquities for half a century.

Dr. Tafel's Journey to North-East Tibet.—A letter, written by Dr. Tafel from the Barun district of Tsaidam on August 1, 1906, is printed in the twelfth number of *Petermanns Mitteilungen* for that year. It gives a brief account of the writer's explorations in the region of the upper Hwang-ho since the dates of his previous communications (*Journal*, vol. **28**, pp. 398, 506). On April 23 he had started from Shara-kuto, the last frontier post of the Chinese, a little to the south-east of the Kuku Nor, the snow then still lying nearly a foot in depth. An icy wind also blew, and a considerable number of his yaks soon succumbed to the hardships of the march. Keeping generally east of the route followed by previous explorers (including that of Lieut. Filchner and himself in 1904), Dr. Tafel encountered greater physical difficulties, it being necessary to cross all the valleys and streams running east or south-east to the main river, and his progress was at last stopped by the Churnon-chu, a deep and rushing stream, beyond which rose a mass of mountain chains with the north-west to south-east direction characteristic of the Kwen-lun system. A renewed attempt to reach the Amne-mashin by the route of Kozlof and Roborovsky proved fruitless, and Dr. Tafel seems to have

turned north-west for Tsaidam, though not before he had obtained fresh proof of the extraordinarily sharp bend made in this region by the Hwang-ho. He has made extensive zoological collections, as well as a geological examination of the route, and has obtained much material for the improvement of the maps of the region.

French Expedition to Western China.—A mission to Western China and the adjacent Tibetan borderlands has been entrusted to Captain D'Ollone by the Paris Geographical Society and the Comité de l'Asie Française, which latter body, in the December number of its *Bulletin*, announces the departure of the expedition on December 23. Captain D'Ollone, who is accompanied by Lieuts. de Fleurelle and Lepage (the former charged with the topographical and geological work), will proceed *viâ* Tongking to Yunnan, and thence northwards through Sechuan and Kansu, keeping as near as possible to the eastern frontier of Tibet, and studying the aboriginal populations of the region to be traversed—Lolos, Miao-tse, Sifans, etc. He proposes to return through Shensi and Shansi to Peking, and expects to be away about two years. In spite of recent work on the Eastern Tibetan frontier, notably that of Lieut. Filchner and Dr. Tafel, there remains a considerable field for investigation, and interesting results may be anticipated.

AFRICA.

The Abyssinian Agreement.—The agreement negotiated last summer between representatives of Great Britain, France, and Italy in respect of the relations of the three Powers with Abyssinia was finally signed in London on December 13, 1906, the text being printed as 'Treaty Series, No. 1, 1907.' The general purport of the agreement is to pledge the three contracting parties to uphold, as far as possible, the integrity of Abyssinia, and to secure equality of treatment as regards trade, etc., to the subjects of all three. They also agree to take concerted action to secure the maintenance of what are regarded as the special interests of each of the three parties, *e.g.* in the case of Great Britain and Egypt, the regulation of the waters of the Nile and its tributaries. It is agreed that the Jibuti railway shall be prolonged, by the present or any other French company which may be substituted for it with the consent of the French Government, from Dire Dawa to Adis Abeba, with a branch line to Harrar eventually, but the French Government will endeavour to secure the appointment of a British and an Italian representative on the board of the French company. All railway construction in Abyssinia west of Adis Abeba, so far as foreign assistance is required, shall be under the auspices of Great Britain, while the latter reserves the right, conceded by Menelik on August 28, 1904, to construct a railway from British Somaliland to the Sudanese frontier, after previously coming to an agreement with the other two powers. Any railway construction with a view to joining Eritrea with the Benadir coast, west of Adis Abeba, shall, so far as foreign assistance is required, be carried out under the auspices of Italy.

South African Survey Work.—The latest report of the astronomer at the Cape, for the year 1906, records the occupation of stations up to 13° 58′ S. by the parties engaged in the measurement of the arc of the 30th meridian under Dr. Rubin. It had been hoped to organize a central office for the completion of the topographic survey of British South Africa south of the Zambezi, but want of funds had delayed the realization of the project. The field-work of the geodetic survey in the Transvaal and Orange River Colony had been completed, and the results of the survey of Southern Rhodesia had been passed through the press. Telegraphic determinations of the longitude of Accra on the Gold Coast and of St. Helena had been successfully carried out—in the former case, by Major Watherston, R.E., and Mr. Pett; in the latter, by Messrs. Pett and Cox. The results were to place Accra (the exact spot not stated) 49·552 ± 0·086 seconds west of Greenwich,

and St. Helena (the Briars, about 2·7 seconds west of Johnson's observatory on Ladder hill) 22 minutes 50·554 ± 0·087 seconds west of Greenwich; the corresponding values in arc being approximately 12′ 23·3″ and 5° 42′ 38″·3 west of Greenwich. Facilities were given at the observatory for the exchange of signals with Swakopmund, but the results had not been received.

Journey over the Masai Steppe.—Dr. Jaeger, whose account of Mount Meru is referred to in the January number, p. 88, has lately made a trip across the arid steppe to the west of the Pangani river, the physical characteristics of which have hitherto been imperfectly understood. A short account of the journey is given in the *Zeitschrift* of the Berlin Geographical Society (1906, pp. 579–581). The objective was the supposed small lake or series of lakes known as Kiniarok, to reach which it was necessary to make a wide *détour* to the south, as the bridges over the Pangani were all destroyed by the flood-water. As no guides were to be obtained at Mgera, north of the Nguru range, it was necessary to go still further west to the Kiyungu hills, before striking north. Even so, the traveller has eventually to trust to his own guidance across the arid and uninhabited steppe, but was fortunate in finding the widely separated watering-places. Kiniarok was found to be merely a grassy steppe, with no water on the surface even shortly after the close of the rains. The portion of the Masai steppe which had been traversed, formed a very even surface of degradation, from which rose isolated summits ("Inselberge"). This surface is almost certainly older than the fault-scarp by which the steppe falls to the Pangani lowland, and has in course of time been eroded into a gently undulating complex of hill and valley, the elevations consisting of laterite, the depressions of black peaty soil, both sometimes overlain with steppe limestone. Instead of forming, as might have been supposed, an inland basin, the country far to the west of the Pangani belongs morphologically to the basin of that river. Running water is, however, absent, apart from the temporary streams which descend the fault-scarp to the Pangani. Water-holes are of two kinds—those occupying hollows in the rock-surface, which rarely dry up, and those occupying shallow depressions in the valley alluvium, which do not long outlast the rainy season. At this period large portions of the valley-troughs are no doubt under water. The vegetation consists of low thorny scrub, thicker toward the south, on the ridges and slopes, and grass, with some bush, on the valley flats. The country was formerly occupied to some extent by Masai, but now the only signs of habitation are widely separated Wanderobo kraals.

French Survey of the West Coast of Morocco.—Considerable progress has been made during the past year in the execution of the hydrographical survey of the west coast of Morocco, which was commenced in 1905 by a French mission under the command of Naval Lieut. A. H. Dyé (see *Journal*, vol. **27**, p. 199). The French Morocco Committee, under whose auspices the mission is at work, publishes in its November bulletin (*B. Com. Afr. Franç.*, 1906, No. 11, p. 307) Lieut. Dyé's third summary report, in which special attention is directed to the discovery of various submerged rocks in the neighbourhood of Mazagan, and to an important error in the location on existing maps of the stretch of coast from Casablanca to Mogador. The longitudinal reckonings on which the charts have hitherto been based appear to have been at fault to the extent of from 6 to 7 kilometres, the coast-line requiring to be moved that distance west of the position it at present occupies on the maps. The geodetic surveys which were carried out in 1905, from Laraiche into the Sebu valley, and from Mazagan to Saffi, have during the past year been supplemented by surveys between Mogador and Saffi, and between Rabat and Casablanca. The mission is still in progress, and by the end of the present year (1907) it is hoped to publish a new general map of the whole stretch of coast

from Tangier to Agadir. Numerous soundings have also been taken during the past year in the coastal waters from Saffi to Rabat, and these, in conjunction with the hydrographical observations which were secured in the previous year, have enabled many improvements to be introduced into the charts of this part of the African coast. Eight sheets of maps based on the soundings taken in 1905 have been completed, and three sheets showing the results of last year's hydrographical studies are in course of preparation, while numerous special reports on a variety of subjects—economic, sociological, commercial, political, medical—are also included in the results of the mission.

Tristan Da Cunha.—A Blue Book, embodying correspondence relating to Tristan Da Cunha, includes an interesting and comprehensive account of the island and islanders. At a distance of 1500 miles from the Cape and 2000 from Montevideo, the island, from a circular base of 31 to 34 square miles, rises, a symmetrical volcanic cone, extinct during historic times, to a height of 7640 feet. Owing probably to wave-erosion, the outline of the base presents a barrier of nearly vertical cliffs, 1000 to 2000 feet from beach to crest. The first climb to the summit, above the cliffs, was made, 1817, by Captain Carmichael. In an account of his visit, read before the Linnean Society, he estimates the principal crater at nearly a mile in circumference, the southern edge 250 feet lower than the northern, with a shallow lake at its bottom, 150 yards in diameter. Other craters are scattered over the declivity of the dome. The cliffs are thickly clothed with tussock grass 8 to 10 feet high, under shelter of which lie the moss-and-mud nests of the "molly hawk" and "sooty albatross." Clumps of a scrubby tree, interspersed with the grass, provide firewood. On the rich pasture (dying off in winter) of a plateau 100 feet above the sea, thriving cows yield very good milk. Much moisture is discharged from the cloud encircling the summit. Unfortunately, no meteorological record has been kept. Lieut. Rich's statistics (August–November, 1816) give the mean temperature at 55° Fahr., maximum 82°, minimum 40°. Captain Cloete reports (1816 and 1817) "Constant rains." Of peculiar interest is the account of the islanders. Numbering seventy-seven on January 23, 1904, distributed among seventeen families, they come of a very mixed ancestry, including Dutch, Italian, African, and Asiatic. Rather above the average type of European peasantry, they show no sign of physical or mental deterioration, though, from want of intercourse, slow of speech and action. There is no government proper, no laws, no crime or immorality, no envy or malice, but they readily render one another voluntary assistance. They therefore refuse the offer of transportation to the Cape, however attractive the conditions. Resources still unexploited within reach of the islanders, are the working of guano deposits on Nightingale and Inaccessible islands, whaling, and fish-curing. The establishment of Tristan as a port of call, and that of a weather-forecast station, seems advisable.

AMERICA.

Recent Survey of Niagara.—The summary report of the Geological Survey of Canada for 1905, issued towards the close of last year, contains some interesting notes by Prof. J. W. Spencer on his recent examination of Niagara, which has supplied new and valuable data for calculating the rate of recession of the fall, as well as for an estimate of the results to be expected from the power-utilization schemes lately set on foot. Prof. Spencer's former contributions to our knowledge of the history of the falls are well known. His recent survey, the first undertaken on the Canadian side, was commenced in October, 1904, and was devoted exclusively to the Canadian falls, the recession of the American falls being immaterial on account of its slowness. It results from his work that during the years 1890 to 1905 the recession has been only about half of that of the previous fifteen years. Only a

small part of this reduction can be traced to the use of the water on the American side, much being due to the greater resistance lately offered by the shape of the crest, for it has been found that the rate of recession is far from uniform. Another cause is the lessened discharge occasioned by the changing level of Lake Erie. Prof. Spencer finds that the recession is not caused solely by the undermining of the hard overhanging limestones, but that these are breached along joints, and finally wedged off, allowing the water to strike upon lower ledges. A special feature at the edge of the fall is the alternation of a broad or flat crescent with one having a wedge-shaped apex. The amount of recession has averaged 2·2 feet per annum as compared with 5·4 feet between 1875 and 1890. Since 1842 the centre of the falls has receded 285 feet, all effected before 1886, the subsequent processes having merely widened the crescent. Nine-tenths of the total discharge of Niagara comes down through the Canadian channel, and the level of the river above is determined by a ledge of rock which extends near the head of Goat island almost to the Canadian shore. As the largest power company takes its water at the end of this ridge, it is certain that a large volume of water will be drawn off from the New York side, the whole discharge from the Canadian falls being also affected. The contemplated reduction of 10 to 15 per cent. will narrow the channel, and divert the water from its shallower portions. Prof. Spencer points out that the international boundary is not, as has often been supposed, a changeable feature, but was established by the commissioners in 1819. It runs about 300 feet from Goat island (thus placing all but one horn of the crescent of the Canadian falls within Canadian territory), and is not far from the deep part of the channel. Prof. Spencer has carried out, under considerable difficulties, soundings of the river at various points in the gorge, using Tanner-Blish sounding-tubes, which effect their purpose by recording the weight of the superincumbent water. Many remarkable features have been brought out: thus close under the Goat island shelf a depth of 192 feet was found. The full results are, however, withheld until the significance of the whole can be presented. Prof. Spencer has seen reason to increase his former estimate of the age of the falls, and of the length of time which must elapse before the diversion of the waters into the Mississippi.

The Bogoslov Islands, Bering Sea.—The three islands known by this name have all made their appearance above the sea within the space of little more than a century, the third and largest rising above the water about the time of the great Californian earthquake, on which account some have supposed a connection to have existed between the two disturbances. Some notes on this and the earlier islands, with illustrations, are given in the December number of the *Popular Science Monthly* by President Jordan and Mr. G. A. Clark of Stanford University. These writers are, on the whole, inclined to doubt the possibility of the supposed connection with the San Francisco earthquake, the rise of the third Bogoslov having been attended with little if any disturbance in the immediate vicinity, while the distance and the depth of the intervening sea seem to render the idea improbable. The first island appeared in 1796, and an account of its advent, by a Russian trader, Kriukof, is to be found in Kotzebue's narrative of discovery in 1817. The second island was first seen in September, 1883, by Captain Anderson of the schooner *Matthew Turner*. The islands have been subject to rapid disintegration, and the "Ship rock," which formerly rose above the sea in their midst, has entirely disappeared. The naming of this rock is universally ascribed to Cook during his last voyage, but Prof. G. Davidson calls our attention to the fact that the name occurs neither in the narrative of this voyage nor on the charts published therewith, while inquiry at the Admiralty has elicited the fact that the rock is not named in Cook's original charts. Prof. Davidson points out that the island appears as "Ship

Rock" in A. Arrowsmith's chart of the Pacific of 1798, and says that this cartographer no doubt obtained the name from the journals of officers. A small view of Bogoslov island, with the rock in its vicinity, was given in Lütke's 'Voyage autour du Monde,' 1836.

Earthquake in Jamaica.—Another destructive earthquake, comparable in its effects with those which devastated San Francisco and Valparaiso during 1906, took place in Jamaica on January 14, the city of Kingston bearing the brunt of the shock. Great loss of life and destruction of property are reported, the city being virtually reduced to a mass of ruins, while, as in the case of last year's catastrophes, the fires which broke out did their share in the work of destruction. A serious sinking of the ground took place along a portion of the coast, greatly increasing the depths of water in the harbour, and rendering useless those of the wharves which had escaped destruction by fire. The number of killed cannot be much less than two thousand, a considerable proportion being Europeans, among them Sir James Fergusson, who had lately arrived on a visit. The British delegates to the Agricultural Congress, which had just been opened by the Governor, all, however, escaped. The area of greatest intensity seems to have had a radius of 10 or 12 miles, beyond which little or no damage was done. It is too soon to enter into the scientific aspects of the event, though it may be noted that, as in other instances, minor earthquake shocks were reported about the same time from other parts of the world, though it would, of course, be hazardous to conclude that any connection necessarily existed between them. It is stated in *Nature* for January 17, that shocks were felt on the 10th of that month at Christiania, Frederikstad, Gottenburg, Arvika, and Upsala, while it has been reported that Trondhjem and a large part of Northern Norway experienced severe earthquake shocks on the 15th. On the 17th a slight shock was felt at Oban and adjacent parts of the west of Scotland. The Mauna Loa volcano in Hawaii has also been reported in active eruption.

American Expedition into the Interior of South America.—A scientific expedition, headed by Dr. W. C. Farabee, instructor in anthropology at Harvard University, has started for South America for the purpose of research, mainly anthropological, in the imperfectly known region on the borders of Peru, Bolivia, and Brazil. Dr. Farabee, who has the support of the Peabody Museum at Boston, and is accompanied by a doctor and two assistants, will proceed *viâ* Colon to Arequipa in Peru, whence he will cross the Andes to the chosen field of work. It is proposed to devote three years in all to the intended investigations.

AUSTRALASIA AND PACIFIC ISLANDS.

The Murchison and Davenport Ranges, Central Australia.—Mr. Allan A. Davidson, whose report on his expeditions to the northern territory of South Australia was referred to in the *Journal* for June, 1906 (p. 633), sends us some notes on the general characters of the above ranges, visited by him, which together form the most striking geographical feature north of the MacDonald range. The general elevation varies between 500 and 1000 feet above the plains, which themselves lie at an altitude of 1000 to 1200 feet above sea-level. The geological formation consists of quartzite, sandstone, conglomerates, etc., with interbedded sheets of eruptive rocks—diorites, diabase, and others. A striking feature is the continuous series of long uniform ridges of quartzite and sandstone, separated by narrow parallel valleys. Their uniformity is only disturbed in the vicinity of the central cores of the pre-Cambrian rocks over which the quartzites have been folded. This system of valleys and ridges has been formed by the denudation of the softer sandstone between hard zones of quartzite, and the rapid decomposition of the

interbedded eruptive rocks which in many places replace the soft sandstone. The ranges are traversed by an extensive series of creeks, many of considerable size, with low banks and sandy channels up to 200 feet in width. On leaving the ranges they cut out channels through the sandy plains for long distances, but gradually die out in sandy country or spread out into pools over loam flats. Water-holes are numerous along the creeks for six months after heavy rains, but the only lasting supply occurs in a few natural tanks cut out of hard rock either by the swirl of a flooded creek at a bend, or by waterfalls. Several kinds of fish, weighing up to 12 ozs., occur in these water-holes, being probably varieties of species which occur in the rivers of the upper territory. Along the eastern flank granite occurs, with eruptive and metamorphic rocks, and both here and in the eruptive belts within the ranges gold, copper, and galena were found, but hardly in paying quantities. The natives appear to be gradually dying out. In the Tennant creek district a peculiar custom was noticed, many of the women being not allowed to speak for long periods after the death of their husbands. An extensive sign language has thus been developed. Animal-life is scarce, though after rains insect and other pests develop with startling rapidity.

Irrigation Scheme for the Murrumbidgee Valley.—We understand that Dr. J. P. Thomson, Secretary of the Queensland Branch of the R.G.S. of Australia, has lately reported to the New South Wales Government on the possibilities of irrigation in the Murrumbidgee basin, in regard to which a vast scheme has lately been set on foot with a view to guarding against the great losses of stock brought about by the droughts of recent years. The most important part of the scheme is the formation of a great reservoir by the erection of a dam across the Murrumbidgee at Barren Jack, about 30 miles from Bowning station on the Sydney to Melbourne railway. The river has here cut a deep gorge with walls over 300 feet high through a solid ridge of granite, and it is proposed to build a solid wall 200 feet high across this, impounding the waters of the river for a distance of 40 miles. It is claimed that the capacity of the reservoir will be little inferior to that on the Nile above Assuan, and that the area of irrigable lands will exceed that supplied by the Nile reservoir. The distribution of the water will be effected entirely by gravitation. Dr. Thomson has also inspected the dam now being constructed across the Cataract river to provide Sydney with an additional water-supply. The full height of this is 154 feet.

The New Hebrides Convention.—The protocol respecting the New Hebrides, signed in London by representatives of France and Great Britain on February 27, 1906, was confirmed by a formal convention dated October 20, 1906, the text of which has since been printed as a Parliamentary paper (Cd. 3160). The outcome is virtually to establish a condominium in the islands. In Art. 1 it is laid down that "The group of the New Hebrides, including the Banks and Torres islands, shall form a region of joint influence, in which the subjects and citizens of the two signatory powers shall enjoy equal rights of residence, personal protection, and trade, each of the two powers retaining jurisdiction over its subjects or citizens, and neither exercising a separate control over the group." Each of the powers is to be represented in the group by a high commissioner with a police force under his orders, and provision is made for the regulation of public services, finance, native administration, judicial functions, land questions, and so on. A joint court is established having jurisdiction both in civil and criminal cases, though under the latter head this is apparently valid only in the case of offences committed by natives against non-natives. The provisions in respect of land questions are among the most important, but others have to do with shipping matters, recruiting of labour, and the like. The seat of government is to be at Vila, in the island of Efate.

The Island of Yap, Caroline Group.—A comprehensive and copiously illustrated account of the island of Yap, based on personal study, is given in the *Zeitschrift für Kolonialpolitik* of April and June, 1906. The monograph, which extends to 144 pages, embraces all aspects of the subject. Eighty, or, including its environing reef, 166 square miles in area, Yap is an acute-angled triangle, with its base to the north-east, apex to the south-west. Base and side lines are gashed with deep sea-channels, in many places penetrating through the reef into the interior land. From the mountainous north-east, rising over 900 feet high, runs south-westwards a backbone of gently declining heights, ending in a plain of coralline sand rising but a few metres above sea-level. Belonging botanically to the Malayan archipelago, this land is more fruitful, especially in coco-palms, in the south-west than in the mountainous chain running north-east. The salt-water zone is occupied with mangrove. The strand zone is mostly barren sand. The cultivated zone, covering the depressions of the coast and part of the ascending land, consists of confused forest, field, and garden. Villages of irregularly scattered houses and huts lie between the wild tropical woods and the partly wild growths of coconuts, breadfruits, *Pangium edule*, etc. Round the detached dwellings lie little gardens of bananas, papaws, sweet oranges, water-melons, citrons, pumpkins, bananas, etc.; at further distance, in particularly favourable sites, are smaller fields of taro, yams, sweet potatoes and sugar-cane. The European eye misses the presence of flowers. Save for the frequently occurring pandanus, mountain ridges and tops are almost treeless, and attempts at afforestation have as yet met with the scantiest success. Tropical in climate, the mean temperature in the shade is between 82° and 90° Fahr. There is no sharply divided dry and rainy season; the climate is strikingly uniform. In Yap the variation of temperature throughout the year does not amount to more than 9° Fahr. Nor is the temperature by night considerably less than by day. Poor in its flora, Yap is perhaps still poorer in its fauna. Of mammals it has only the rat, mouse, and bat. Dogs and pigs have been introduced. The latter are numerously distributed over the island, but the flesh is of very poor quality. There are almost no singing birds, but Yap is exceedingly rich in its marine fauna. The greater part of the paper is devoted to the anthropology of Yap.

POLAR REGIONS.

Captain Amundsen's Voyage and its Results.—As has already been announced, Captain Amundsen has promised to give an account of the voyage of the *Gjöa*, by the North-West Passage, at the meeting of the Society on February 11. Meanwhile, we learn from a Norwegian correspondent that the observations taken during the expedition have arrived safely at the Ethnographic Museum in Christiania, where the two large iron cases, formerly oil-tanks, which contained them, have lately been opened. The contents consisted of 94 different items—57 of magnetic observations in duplicate, 13 tin boxes of magnetic curves (photographic), 20 meteorological journals in rough and transcript, and lastly 4 parcels of astronomical observations. The meteorological records consist of the journals kept during the whole voyage from Christiania to King's point, together with the barograms and thermograms taken with the self-registering apparatus at the two winter stations, Gjöahavn and King's point. A separate journal of the Aurora Borealis was also kept. The magnetic collections include observations taken at Godhavn in Greenland, at Beechy island, and at Gjöahavn, as well as in King William's Land, Boothia Felix, and at King's point. The self-recording magnetic instruments were set up, and were continuously in action at Gjöahavn from November, 1903, to May, 1905, and at King's point from October, 1905, to March, 1906. All the magnetic observations are said to be as complete and correct as if made at any

of the great European observatories. The photographic magnetic curves have been developed, and are in a good condition. All of them are good and successful. The value of these observations is out of all proportion to the cost of the Gjöa Expedition, which amounted to about £1800 only.

Dr. Thalbitzer's Expedition to East Greenland.—In the summer of 1905 Dr. W. Thalbitzer left Europe, accompanied by his wife, with a view to spending a year at the remote Danish trading station at Angmagsalik, the only permanently inhabited spot on the east coast of Greenland, which enjoys communication with the outside world only once in the year by means of a steamer which visits it during the summer, starting from the more frequented west coast. Dr. Thalbitzer has now returned to Europe after successfully accomplishing his purpose, which consisted in linguistic and ethnological research among the long isolated Eskimo of that part of Greenland. In order to make use of the yearly steamer, he was obliged to proceed first to the west coast, and reach his destination by doubling Cape Farewell and penetrating (after some delay through stormy weather) the unusually broad stream of ice carried down the east coast by the polar current. During his stay at the settlement (which derives its name from an important fjord, called by the natives Ammattalik, from a small fish, *Mallotus villosus*, which occurs in large numbers there), Dr. Thalbitzer was able to collect a large amount of new material in the form of folk-songs and tales, mystic formulæ, etc. The whole district now possesses a population of only about 450 souls, who display in many ways a higher degree of culture than the West Greenland Eskimo, and find a rich hunting-ground in the fjords of the neighbourhood. Dr. Thalbitzer also studied the language of the people, which differs from that of the West Greenlanders, and brought back phonograph records of their songs, etc.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Limits of a Coastal Zone: Alluvial Flats of the Arno.—The problem of the exact definition of the "coastal zone" (also with less exactness termed the "coast") has engaged considerable attention within recent years. While the popular idea of a coast refers merely to the portion of land immediately adjoining the sea, the attempt has been made by geographers to lay down limits, more in accordance with scientific requirements, for the belt of country differentiated from the inland region by its relation to the sea. Some writers, among whom was Ratzel, took into account anthropogeographical or biological factors, while others restricted themselves to those concerned with geology or morphology. Very various results have thus been reached, while some have denied that any useful conclusion can be attained by the inquiry. The latest contribution to the subject is an elaborate paper by Dr. R. Hunger in the *Mitteilungen* of the Leipzig 'Verein für Erdkunde' for 1905 (issued during 1906). In reviewing the work of his predecessors, Dr. Hunger agrees with Ratzel that it is impossible to arrive at any generally applicable definition, but that the limits must be laid down in individual cases according to the type of coast or the particular object in view. He considers that, broadly speaking, it is the geological and morphological factors on which stress should be laid, and that the question should be separately studied with regard to the various physical types of coast. As a special case he has chosen the Tuscan coast at the debouchment of the Arno and neighbouring streams, into the geological and topographical history of which he enters with great minuteness. He shows that, while this region has been subjected to great changes within the historic period owing to the rapid accumulation of the sediment brought down by the rivers, the changes since the opening of the Quarternary period are far greater, and account must be taken of these in defining the interior limit of the coastal flats. At that epoch the

sea penetrated far inland by a series of arms which reached, on the present course of the Arno, to the site of the village of Fucecchio. The Monte Pisane then formed an island, while east of this a long tongue of land ran down to near Pontedera, with water on each side of it. The limits assigned by Dr. Hunger follow in the main the contour of the higher ground by which the river-flats are bounded, but portions of the valleys which have been excavated within recent times are excluded. The surface features corresponding to the limits of the coastal zone are described in somewhat wearisome detail, and a doubt may be felt whether the exact definition of the coastal flats is of the importance which Dr. Hunger attaches to it. However, the paper is of interest from the light which it throws on the past changes of the coast-line and the relative rates of advance at different periods. The extension of the land since about 900 A.D. is marked by a succession of parallel lines of dunes of which the innermost reaches the greatest altitude, and probably marks a period of relative standstill, the subsequent more rapid advance being ascribed in part to the effects of human settlement (*e.g.* the deforestation of the hill-sides). The gradual increase of the distance between Pisa and the sea since the founding of the city can be deduced from historical data. An interesting section traces the history of human settlement in the area in question.

Measurement of the Height of Clouds by Reflectors.—Following the erection, on the Schwarzenbergplatz, Ringstrasse, of the "Leuchtbrunnen" (light-fountain), a new, simple, and altogether exact method has been arrived at in Vienna for determining the height of the clouds above the surface of the Earth. The illumination by electric reflectors of the high-jet fountain is effected from beneath. Does the cone of light, ascending perpendicularly, strike the cloud, it imprints on it a light-spot. Dr. J. Rheden, assistant at the Vienna astronomical observatory, hitherto known by his feats in the field of astrographics, noting the fact, bethought him to measure the angle of elevation (α) of the light-spot on the clouds, as seen from the astronomical observatory. The distance (d) of this point of observation from the source of light (the Leuchtbrunnen) being exactly known, the height (h) of the light-spot, *i.e.* of the clouds, becomes readily determinable ($h = d \tan \alpha$). The first measurements were instituted from June 14 to 24, and the results showed the clouds to be at heights of from 5000 to 33,000 feet. By these experiments it was found that sometimes under perfectly clear weather, on projecting the cone of light aloft, the light-spot appeared as an indication of the existence of a layer of moisture. As is well known, the clouds often lie in layers at very unequal heights one above another, such as the naked eye itself distinguishes. The first observation by reflectors showed the under layer to be at 5100 feet; the upper at 8400 feet. A second gave the lower layer at 9800 feet; the higher at 33,000 feet. Finally, a third observation showed three layers at heights respectively of 6200, 12,500 and 14,000 feet. The new method surpasses in exactitude the most trustworthy of the methods hitherto applied, namely the photogrammetric, determining as it does the altitude in question with positive certainty. It is hoped to start a systematic course of such observations in other parts of the Earth as well. There is no doubt that not only for science, but also for practical weather forecasts, such observations will prove highly serviceable.

GENERAL.

Research Department of the Society.—In opening the first meeting of this department for the present session, Major Close gave a brief account of the work of the Research Committee during the previous year. There had, he said, been two special objects of research—the one being the investigation of rainfall and run-off, as well as the matters in suspension and solution in English rivers; the

other an investigation into the changes that have taken place on the East Coast, especially in the neighbourhood of the Humber estuary. Good advance had been made with the first investigation, while something had been done in regard to the second, a very complete list of books and maps having been compiled by Mr. Shepherd, and lately published. The next step, based on those books and maps, would be to investigate the whole matter in order to see the changes that have actually taken place, and this would go on during the ensuing year. During the course of the past year a considerable number of papers had been read in the Research Department, their subjects being—"The Next Great Arctic Discovery," by Sir Clements Markham; "The Ordnance Survey Maps from the Point of View of the Antiquities on Them," by Mr. Haverfield; "Inquiry into the Resources of the British Empire," by Prof. Scott Elliot; "The Ruins of Rhodesia," by Dr. Randall MacIver; "Distribution of Alpine Races in Europe," by Mr. J. L. Myres; "Physico-Geographical Problems in Seistan," by Sir H. McMahon; and "A Plea for an Expedition to Melanesia," by Dr. A. C. Haddon.

Oceanographical Laboratory at Edinburgh.—A laboratory for oceanographical research, organized through the efforts of Mr. W. S. Bruce, leader of the Scottish Antarctic Expedition, was formally opened by the Prince of Monaco during a visit to the city in January. The laboratory is installed in a portion of the Surgeons' Hall in Edinburgh.

CORRESPONDENCE.

The Survey of India.

Simla, September 12, 1906.

I BEG to acknowledge the receipt of a copy of the Royal Geographical Society's *Journal* for August, 1906. I have been a Fellow of the Society for many years, and receive my private as well as official copies as a matter of ordinary routine, and I therefore presume that the special copy to which I refer was sent me in order to call my attention to the review of the report of the Survey of India for 1903–04 by T. H. H.

I have no intention of embarking on any paper controversy, but I wish to point out that the review in question conveys a very inadequate idea of the great task that lies before the Survey of India at the present time.

The writer, while remarking that the report is chiefly interesting when read by the light of subsequent recommendations made by the special Survey Committee, proceeds to state that that committee concerned itself mainly with the question of *maintaining* an accurate and up-to-date topographical map of India and of the Indian border, and he goes on to say that it is therefore interesting to observe, from the map illustrating the progress of Imperial Surveys, that there is really very little of the Indian peninsula left to map topographically, etc., etc.

I think he must have overlooked that the committee recommend that a complete topographical map, *on the 1-inch scale*, shall be prepared and published in colours for the whole of India, and, further, that the scale of survey shall be usually at least double the scale of publication. It further lays down that the size of the maps shall be reduced by one-half, that they shall be based on the latest geodetic value of the longitude of Madras, and, though it lays down no definite rules, it laid great stress on the necessity of additional heights and contours, two important details to which all but the latest surveys have paid little attention. The map illustrating the progress of Imperial Surveys does not show the areas that have

been surveyed on scales suitable for the production of modern 1-inch maps, but merely shows the areas surveyed from the date of the commencement of survey work in India by organized parties of some form or other on a variety of scales, and the maps of vast areas are entirely out of date owing to their antiquity. As a matter of fact, there are at the present time no maps of India on the 1-inch scale which, either in form or quality, meet the requirements of the committee, and the whole series will have to be re-drawn. Those more nearly conforming to modern requirements cover a large portion of Burma and small areas in the Punjab, the Central Provinces, and the United Provinces, and next to these come the maps of the Bombay Presidency, of Mysore, and of portions of the Punjab, but none of these are based on the latest value of the longitude of Madras.

A glance at the "General Map to illustrate the Distribution of the Various Classes of Survey Work required for the Preparation of a Topographical Map of India on the scale 1 inch = 1 mile," published opposite p. 115 of vol. 1 of the Survey Committee's report, will give a rough idea of the work to be done. Of the areas coloured red no surveys on the 1-inch scale have ever been made, and consequently these areas must be actually surveyed on either the 1-inch or the 2-inch scale. Of the areas coloured, blue maps in some shape or other on the 1-inch scale exist, and this colour is used to denote areas where the topography will have to be re-done, but the trigonometrically fixed points *may* be found sufficient to obviate the necessity of re-triangulation.

The area under these two headings above amounts to approximately 1,159,300 square miles (*vide* p. 43, vol. 1, of the committee's report). Taking the area of India and its dependencies at approximately 1,830,600 square miles, and the area to be actually surveyed, or "re-surveyed" as opposed to "revised," at 1,159,300, it will be seen that in the twenty-five years allowed for the completion of the work no less than 73,224 square miles will have to be fair mapped, and 46,372 square miles will have to be actually surveyed or "re-surveyed" on the 1-inch or the 2-inch scale yearly, a task that no nation has yet had to attempt, and one which will require the utmost energy and determination to accomplish. Perhaps, if all goes well, some twenty-five years hence T. H. H.'s estimate of the work now before the department may be applicable to the then immediate future, but at present it falls far short of the absolute facts.

F. S. LONGE, Col. R.E.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1906-1907.

Christmas Lecture, Friday, January 4, 1907.—"Japan and the Japanese as I saw them." By Miss A. L. Murcutt.

Christmas Lecture, Monday, January 7, 1907.—"A Lady's Journey from the Cape to Cairo." By Miss Mary Hall.

The Right Hon. Sir G. T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

***Fifth (Special) Meeting, January* 12, 1907.** The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

The paper read was :—

"An Expedition to Mount Ruwenzori." By His Royal Highness the Duke of the Abruzzi.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendes.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Italy—Sicily. *C.R.A. Sc.* **142** (1906): 1001–1003. **Lugeon and Argand.**
Sur la grande nappe de recouvrement de la Sicilie. Note de MM. Maurice Lugeon et Emile Argand.

Italy—Vesuvius. *National G. Mag.* **17** (1906): 318–325. **Jaggar.**
The Eruption of Mount Vesuvius, April 7–8, 1906. By T. A. Jaggar, junr. *With Illustrations.*

Italy—Vesuvius. *C. Rd.* **142** (1906): 941–944. **Lacroix.**
Sur l'éruption du Vésuve et en particulier sur les phénomènes explosifs. Note de A. Lacroix.

Italy—Vesuvius. *C. Rd.* **142** (1906): 1020–1022. **Lacroix.**
Les conglomérats des explosions vulcaniennes du Vésuve, leurs minéraux, leur comparaison avec les conglomérats trachytiques du Mont-Dore. Note de A. Lacroix.

Italy—Vesuvius. *C. Rd.* **142** (1906): 1244–1249. **Lacroix.**
Les avalanches sèches et les torrents boueux de l'éruption récente du Vésuve. Note de A. Lacroix.

Jura. **Legaret.**
B.S.G. Lyon **19** (1904): 253–271; **20** (1905): 42–54, 115–128, 215–231, 301–313; **21** (1906): 31–49.
Répartition et Mode de Groupement des populations dans le Jura Central et Méridional. Par G. Legaret.

Lake of Constance. *Globus* **89** (1906): 284–285. **Halbfass.**
Seenkunde und Völkerrecht. Von Prof. Dr. W. Halbfass.
Discusses a question of jurisdiction that has lately arisen.

Norway. *B. American G.S.* **38** (1906): 337–348. **Brigham.**
The Fiords of Norway. By A. P. Brigham.

Norway—Anthropology. *Skrifter Vidensk. S. Christiania*, 1905 (No. 5): pp. 29. **Daae**
Indlands- og Kystbefolkningens Legemshøide, Favnevidde, Brystomfang og Siddehøide. Ved A. Daae og H. Daae. *With Maps.*
Compares the measurements ascertained for inland and coast dwellers.

Norway—Climate. *Z. Gletscherkunde* 1 (1906): 46–61. **Øyen.**
Klima- und Gletscherschwankungen in Norwegen. Von A. P. Øyen. *With Illustrations.*

Norway—Historical. *Forhandl. Vidensk.-S. Christiania* (1905): No. 5, pp. 29. **Olsen.**
Det gamle norske ønavn Njarðarlog. Af Magnus Olsen.

This name is used for the first time in Olav Tryggvessøn's saga, for the island at the entrance to Hardangar fjord, now called Tysnesø.

Norway—Magnetism. **Geelmuyden.**
Skrifter Vidensk-S. Christiania, 1905 (No. 3): pp. 23.
Den magnetiske Misvisning i Norge. Af H. Geelmuyden.

Pyrenees. *B.S.G. Com. Bordeaux* 29 (1906): 185–196, 205–210. **Descombes.**
La propriété communale dans les Pyrénées et l'aménagement des montagnes par l'initiative privée. Par P. Descombes.

Rhone. **Uetrecht.**
Die Ablation der Rhone in ihrem Walliser Einzugsgebiete im Jahre 1904–05. Inaugural-Dissertation . . . vorgelegt von E. Uetrecht. Bern, 1906. Size 10 × 7, pp. 66. *Illustrations. Presented by the Author.*

Rumania—Petroleum. *B.S.G. Română* 27 (1906): 129–156. **Mircea.**
Distribuțiunea geografică a petroleuluĭ în țara noastră, de C. R. Mircea.

Russia. *Deutsch. Erde* 4 (1905): 205–207. **Hasse.**
Die Deutschen in Russland. Von Ernst Hasse. *With Map.*

South-West Europe—Place-names. *Deutsch. Erde* 4 (1905): 41–47. **Jungser.**
Deutsch-spanische Ortsnamen. Von Johannes Jungser. *With Maps.*

Sweden. ———
Svenska Turistföreningens Årsskrift, 1906. Stockholm: Wahlström & Widstrand, 1906. Size 8½ × 5½, pp. viii. and 402. *Maps and Illustrations. Presented.*

Sweden and Norway. **Mohn.**
Une page d'Histoire de la Civilisation! La Suède et la Révolution Norwégienne. Par Alfred Mohn. Paris and Geneva, [1906]. Size 7½ × 5, pp. 150. *Price* 1 *fr.* 50. *Presented by Dr. A. G. Nathorst.*

Sweden—Lapmark. *G. Ts.* 18 (1905–06): 227–228. **Porsild.**
Den naturvidenskabelige Station ved Vassijaure i Torne Lapmark. Af Morten P. Porsild. *With Sketch-map and Illustration.*

Sweden—Meteorology. *K. Svensk. Vet.-A. Handl.* 40, No. 1 (1906): pp. 60. **Hamberg.**
Moyennes mensuelles et annuelles de la température et extrêmes de température mensuels pendant les 150 années 1756–1905 à l'Observatoire de Stockholm. Par H. E. Hamberg. *With Diagrams.*

Switzerland. ———
Statistique de la Suisse, 148ᵉ Livraison. Mouvement de la Population de la Suisse pendant l'Année 1904. Berne: A. Francke, 1906. Size 11 × 9, pp. 32.

Switzerland—Fauna. **Bretscher.**
Zur Geschichte des Wolfes in der Schweiz. Von Dr. K. Bretscher. (Neujahrsblatt der Naturforschenden Gesellschaft in Zürich auf das Jahr 1906; 108 Stück.) Zürich, [1906]. Size 11 × 9, pp. 40. *Illustrations.*

Switzerland—Hydrology. **Schardt.**
B.S. Belge Géologie (Mém.) 19, 1905 (1906): 559–570.
Note sur l'origine des sources vauclusiennes de la Doux (source de l'Areuse) et de la Noiraigne, canton de Neuchâtel (Suisse). Par H. Schardt. *With Profiles.*

Switzerland—Hydrology and Meteorology. ———
Table de Récapitulation des Principaux Resultats des Observations hydrométriques suisses, 1902. Bern, 1905. Size 15 × 10, pp. 60.
Tableaux graphiques des Observations hydrométriques suisses et des températures de l'air et des hauteurs pluviales, 1904. Bern, 1905. Size 15½ × 10. *Diagrams.*

Turkey—Samothrace. *Deutsch. Rundschau G.* 28 (1906): 352–357. **Schleiff.**
Eine Besteigung des Phengari auf Samothraki. Von Direktor V. Schleiff.

United Kingdom—Archæology. *P.R.S., Ser. A.* 77 (1906): 465–472. **Lockyer.**
On the Observations of Stars made in some British Stone Circles. Second Note. By Sir Norman Lockyer. *With Diagram.*

United Kingdom—Ireland—Limnology. *T.R. Irish A.* 33 (1906): *B.*, 77–116. **West**
A Comparative Study of the Plankton of some Irish Lakes. By W. West and Prof. G. S. West. *With Plates.*

United Kingdom—Scotland. *Z. Gletscherkunde* 1 (1906): 21–30. **Geikie.**
Late Quarternary Formations of Scotland. By Dr. James Geikie, F.R.S. *With Diagram.*

United Kingdom—Wales. *Geol. Mag.* 3 (1906): 262–265. **Greenly.**
The River Cefni in Anglesey. By E. Greenly. *With Sketch-map.*

United Kingdom—York. **Auden and others.**
A Handbook to York and district. Prepared for the 75th Meeting of the British Association for the Advancement of Science, 1906. Edited by Dr. G. A. Auden. York: J. Sampson, 1906. Size 7½ × 5, pp. xvi. and 366. *Plan and Illustrations.*

AFRICA.

South Africa—Geology. **Hatch.**
Presidential Address, delivered to the Geological Society of South Africa, at the Annual Meeting, on January 29, 1906. By Dr. F. H. Hatch. [From the *Proceedings* of the Geological Society of South Africa, 1906, pp. xxi.–xxxiv.] Size 10 × 7½. *Presented by the Author.*

On the South African, especially the Transvaal, geological formations.

Togo. *M. Deutsch. Schutzgeb.* 19 (1906): 113–131. **Koert.**
Das Eisenerzlager von Banjeli in Togo. Von Dr. Koert. *With Map and Plate.*

Transvaal—Ethnology. *J. Anthrop. I.* 35 (1905): 365–386. **Gottschling.**
The Bawenda: a Sketch of their History and Customs. By the Rev. E. Gottschling. *With Plate.*

Transvaal—Irrigation. *Transvaal Agricultural J.* 4 (1906): 733–742. **Hurley.**
Irrigation in the Transvaal. By F. A. Hurley.

Uganda. *Alpine J.* 23 (1906): 185–202. **Freshfield.**
Towards Ruwenzori.—II. By D. W. Freshfield. *With Illustrations. Also separate copy.*

West Africa—Boundary. ——
Treaty Series. No. 14, 1906. Convention between the United Kingdom and France respecting the Delimitation of the Frontier between the British and French Possessions to the East of the Niger. Signed at London, May 29, 1906. London: Wyman & Sons, 1906. Size 10 × 6½, pp. 10. *Maps. Price* 1s. 1d.

See note in the Monthly Record for November, 1906 (p. 509).

West Africa—Boundary. *Deutsch. Kolonialblatt* 17 (1906): 593–595. ——
Grenzfestsetzung zwischen dem deutschen Gebiete Nordwest-Kamerun und dem britischen Gebiete Nigeria von Yola an bis zum Tschad-See. *With Map.*

See *Journal* for November, 1906, p. 509.

NORTH AMERICA.

United States—North Carolina. **Cobb.**
Notes on the Geology of Currituck Banks. By Collier Cobb. (Reprinted from the *Journal of the Mitchell Society*, vol. 22, No. 1.) Size 9 × 6, pp. [4].

United States—Pennsylvania. **Falckner and Sachse**
Falckner's Curieuse Nachricht von Pennsylvania. The book that stimulated the great German Emigration to Pennsylvania in the early years of the eighteenth Century. A Reprint of the Edition of 1702, amplified with the Text of the Original Manuscript in the Halle Archives. Together with an Introduction and English Translation of the Complete Work. By Dr. J. F. Sachse. Philadelphia, 1905. Size 10 × 7, pp. x. and 256. *Facsimile Maps and Illustrations. Price* $3 *net.*

United States—Texas. *Science* 23 (1906): 849–851. **Udden.**
The Origin of the Small Sand Mounds in the Gulf Coast Country. By Prof. J. A. Udden.

United States—Texas. *Science* **23** (1906): 818-819. **Wentworth.**
A Few Notes on "Indian Mounds" in Texas. By Irving H. Wentworth.

United States—Virginia. *National G. Mag.* 17 (1906): 358-362. ———
The Luray Caverns. *With Illustrations.*
These caverns are in the Shenandoah valley.

CENTRAL AND SOUTH AMERICA.

Peru—Irrigation. *B. Cuerpo Ingen. Minas Perú*, No. 34 (1905): pp. 42. **Hurd.**
Estudio para aumentar las aguas del Rio Chili (Arequipa). Por H. C. Hurd. *With Maps and Diagrams.*

Rio de la Plata. *B.I.G. Argentino* **22** [Part 2]: 89-121. **Martinez.**
Etnografia del Rio de la Plata. Por Benigno T. Martinez.

South America. **Créqui-Montfort.**
Int. Amerikanisten-Kongress **14** *Tag.*, 1904 (1906): 531-550.
Fouilles de la mission scientifique française à Tiahuanaco. Ses recherches archéologiques et ethnographiques en Bolivie, au Chili et dans la République Argentine. Par le Comte G. de Créqui-Montfort. *Illustrations.*

South America—Archæology. **Uhle.**
Int. Amerikanisten-Kongress **14** *Tag.*, 1904 (1906): 567-579.
Bericht über die Ergebnisse meiner südamerikanischen Reisen. Von Dr. M. Uhle. *Illustrations.*

Trinidad. *J.R. Col. I.* **37** (1906): 487-502. **Craig.**
The Oilfields of Trinidad. By E. H. Cunningham Craig.

Uruguay. ———
Años 1902 y 1903. Anuario Estadístico de la República O. del Uruguay. Tomo II. Montevideo, 1906. Size 11½ × 8, pp. xx. and 802. *Diagrams.*

West Indies—Leeward Islands. **Watts.**
Report on the Sugar Industry in Antigua and St. Kitts, Nevis, 1881 to 1905. By Francis Watts. (Colonial Reports, Miscellaneous No. 35, 1906.) Size 10 × 6, pp. 16. *Diagrams. Price 3d.*

AUSTRALASIA AND PACIFIC ISLANDS.

South Australia—Meteorology. **Todd.**
Meteorological Observations made at the Adelaide Observatory, and other places in South Australia and the Northern Territory, during the years 1902-1903, under the direction of Charles Todd. Adelaide, 1905. Size 13 × 8½, pp. xx., 110, and 66. *Map.*

Tahiti. *Questions Dipl.* **21** (1906): 807-818. **Bracconi.**
La colonisation française à Tahiti. Par P. Bracconi. *With Map.*

Western Australia—Botany. **Diels.**
Die Vegetation der Erde . . . herausgegeben von A. Engler und O. Drude. VII. Die Pflanzenwelt von West-Australien südlich des Wendekreises. Mit einer Einleitung über die Pflanzenwelt Gesamt-Australiens in Grundzügen. Ergebnisse einer im Auftrag der Humboldt-Stiftung der Kgl. Preussischen Akademie der Wissenschaften 1900-1902 Unternommenen Reise. Von Dr. L. Diels. Leipzig: W. Engelmann, 1906. Size 10½ × 7, pp. xii. and 414. *Map and Illustrations.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Oceanography. *J. Geology* **14** (1906): 221-225. **Lane.**
The chemical evolution of the Ocean. By A. C. Lane.

Oceanography. ———
Conseil Permanent International pour l'Exploration de la Mer. Rapports et Procès-Verbaux des Réunions. Volume 4. Juillet, 1904—Juillet, 1905. Copenhagen, 1905. Size 10½ × 8½, pp. xxxviii., 104, and 74. *Chart.*

Oceanography—Atlantic. *La G.* **13** (1906): 425-436. **Pettersson.**
L'Atlantique, mer inexplorée. Par O. Pettersson. *With Diagrams.*

Oceanography—Black Sea. *Ann. Hydrographie* **34** (1906): 162–179. **Wissemann.**
Die Oberflächenströmungen des Schwarzen Meeres. Von W. Wissemann. *With Diagrams.*

Oceanography—Catalogue. ——
Internationale Ausstellung für Meereskunde und Seefischerei in Marseille, 1906. Amtlicher Führer durch die Deutsche Abteilung. Size 9½ × 6, pp. 24. *Plate. Presented by the German Commission to the Exhibition.*

Oceanography—Currents. **Berget.**
B. Musée Oceanograph. Monaco, No. 73 (1906): pp. 20.
Cours d'Océanographie fondé à Paris par S. A. S. le Prince Albert de Monaco (2e année). Les Courants marins—Le Gulf-Stream. Par A. Berget. *With Diagrams.*

Oceanography—Currents. *Ann. Hydrographie* **34** (1906): 114–122. **Forch.**
Zur Theorie der Meeresströmungen. Von C. Forch.

Oceanography—Dead Water. **Ekman.**
On Dead Water: being a description of the so-called phenomenon often hindering the headway and navigation of ships in Norwegian Fjords and elsewhere, and an experimental investigation of its causes, etc. By V. W. Ekman. With a Preface by Prof. V. Bjerknes.—The Norwegian North Polar Expedition, 1893-1896. Scientific results. Vol. **5**, xv., pp. 1–152. London: Longmans & Co., 1906. *Maps and Plates.*

Oceanography—Depths. ——
List of Oceanic Depths and Serial Temperature Observations received at the Admiralty during the year 1905, from H.M. Surveying Ships and British Submarine Telegraph Companies. London: J. D. Potter, 1906. Size 13½ × 8½, pp. 32. *Price 2s.*

Oceanography—Expedition. *Ann. Hydrographie* **34** (1906): 145-147, 220-227. ——
Die Forschungsreise S.M.S. "Planet."

Oceanography—Instrument. **Marini.**
Ludovico Marini. Il Mareografo d'alto Mare del Comandante Mensing. Metodi per la misura della pressione a profondita nel mare. Stazioni talassologiche autoregistatrici complete. (Rivisita Maritima: Estratto dal fascicolo di dicembre, 1905.) Rome, 1905. Size 9 × 6½, pp. 20. *Diagram. Presented by the Author.*
The instrument shows the changes of tide by registering the variations of pressure.

Oceanography—North Sea. **Reibisch.**
Faunistisch-biologische Untersuchungen über Amphipoden der Nordsee. II. Teil. Von Dr. J. Reibisch. (Aus dem Laboratorium für internationale Meeresforschung in Kiel. Biologische Abteilung Nr. 6.) Kiel, 1906. Size 13 × 10½, pp. 185–235. *Plates.*

Oceanography—Plankton. ——
Conseil Int. Exploration Mer, Publ. Circonstance, No. 33 (1906): pp. viii. and 122.
Catalogue des espèces de plantes et d'animaux observées dans le plankton recueilli pendant les expéditions périodiques depuis le mois d'août 1902 jusqu'au mois de mai 1905. Publié . . . avec la coopération de C. H. Ostenfeld.

Phytogeography. *Naturw. Wochenschrift* **5** (1906): 305–310. **Potonié.**
Die Fichte als Moorbaum und über unsere Moore. Von H. Potonié. *With Illustrations.*

Seismology. *Nineteenth Century* **60** (1906): 647–650. **Gardner.**
The Problem of Earthquakes. By J. S. Gardner.

Seismology. *Atti R.A. Lincei; 5. Rendiconti* **15** (1906): *I. Sem.*, 15-18. **Monti.**
Sulla misura della velocità di propogazione delle perturbazioni s'smiche in rapporto alla sismometria razionale. Nota di V. Monti.

Speleology. *Spelunca* **6** (1905): pp. 810. **Martel.**
La Spéléologie au XXe siècle. (Revue et Bibliographie des Recherches Souterraines de 1901 à 1905.) *With Plans and Illustrations.*
A valuable summary of recent research, with bibliography.

Terrestrial Magnetism. *Terrestrial Magnetism* **11** (1906): 65–92. **Bauer.**
The Magnetic Survey of the North Pacific Ocean: Instruments, Methods, and Preliminary Results. By L. A. Bauer. *With Map and Illustrations.*

Terrestrial Magnetism. *Met. Z.* 23 (1906): 145–149. **Hellmann.**
Ueber die Kenntnis der magnetischen Deklination vor Christoph Columbus. Von G. Hellmann. *With Plate.*

Terrestrial Magnetism. *C. Rd.* 143 (1906): 139–140. **Mercanton.**
Sur l'inclinaison magnétique terrestre aux époques préhistoriques. Note de P. L. Mercanton.

Tides. *National G. Mag.* 17 (1906): 303–309. **Harris.**
Cotidal Lines for the World. By R. A. Harris. *With Maps.*

Volcanoes. *J. Geology* 14 (1906): 259–268. **Dutton.**
Volcanos and Radio-activity. By Major C. E. Dutton.

Zoology. *National G. Mag.* 17 (1906): 367–423. **Shiras.**
Photographing Wild Game with Flashlight and Camera. By Hon. G. Shiras. *With Illustrations.*

Striking photographic pictures from life.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Historical—Early Travels. **Purchas.**
Hakluytus Posthumus or Purchas His Pilgrimes. By Samuel Purchas, B.D. Vols. 15 and 16. Glasgow: James MacLehose & Sons, 1906. Size 9½ × 6, pp. (vol. 15) xiv. and 568; (vol. 16) xx. and 580. *Illustrations. Price 12s. 6d. net per volume.*

Historical—Maps. *B. American G.S.* 38 (1906): 365–368. ———
The Leardo Map of 1452.

This map, a facsimile of which appeared in Ongania's collection, has lately been presented to the American Geographical Society.

Historical—Tavernier. *J. Asiatique* 7 (1906): 273–280. **Hamy.**
Une lettre inédite du voyageur J.-B. Tavernier (1664), publiée et commentée par le Dr. E.-T. Hamy.

Political. *John Hopkins University Studies* 24 (1906): Nos. 5, 6, pp. 196. **Hildt.**
Early Diplomatic Negotiations of the United States with Russia. By John C. Hildt.

Transport. *Deutsch. G. Blätter* 29 (1906): 154–176. **Egerer.**
Die Entwicklung der städtischen Personenverkehrsmittel. Von E. Egerer.

GENERAL.

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The English Catalogue of Books (including the original "London" and "British" Catalogues), giving in one Alphabet, under Author and Title, the Size, Price, Month, and Year of Publication, and Publisher of Books issued in the United Kingdom of Great Britain and Ireland. Vol. 7. January, 1901, to December, 1905. London: The Publishers' Circular, Ltd., 1906. Size 10 × 6. *Price £3 13s. 6d. net.*

Educational. *Nineteenth Century* 60 (1906): 632–646. **Macnaghten.**
Geography in our Public Schools. By R. E. Macnaghten.

Gazetteer. **Ritter and Penzler.**
Ritters geographisches-statistisches Lexikon über die Erdteile, Länder, Meere, Häfen, Seen, Flüsse, Inseln, Gebirge, Staaten, Städte, Flecken, Dörfer, Bäder, Kanäle, Eisenbahnen, Post- und Telegraphenämter u.s.w. . . . Neunte . . . Auflage. Unter der Redaktion von Johannes Penzler. 2 vols. Leipzig: Otto Wigand, 1905-1906. Size 10½ × 7, pp. (vol. 1) 1248, (vol. 2) iv. and 1360.

Livingstone College. ———
Livingstone College Year Book, [1906]. Containing Hints to Travellers in matters of Health, Outfit, and Travel. Travellers' Health Bureau, Livingstone College, Leyton, E., [*not dated*]. Size 7 × 5, pp. 112. *Illustrations. Presented by the Livingstone College.*

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EUROPE.

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from December 1 to 31, 1906.

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Finland. **Wijkberg and Arppe.**

Karta öfver Storfurstendömet Finland utgifven af Öfverstyrelsen för landtmäteriet, jemlikt Kejserliga Senatens förordnande. Maurus Wijkberg and Wilhelm Arppe. Scale 1 : 2,400,000 or 1 inch to 37·9 stat. miles. Sheets: A4, B3, D3. Helsingfors, 1906.

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: XXII.-13, Pontoise; XXII.-14, Versailles; XXII.-15, Rambouillet; XXIII.-13, l'Isle-Adam; XXIII.-14, Paris; XXIII.-15, Corbeil; XXIV.-13, Dammartin-en-Goële; XXIV.-14, Lagny; XXIV.-15, Brie-Comte-Robert. Paris: Service Géographique de l'Armée, [1906]. *Price* 1.60 *fr. each sheet.*

For many years past the need of a map of France on a larger scale than 1 : 80,000 has been seriously felt, and, in consequence, a number of sheets of the well-known 'Carte de France' on that scale were enlarged to 1 : 50,000, after comparison with the original survey sheets and notes, which are not available to the public. It was, however, found that this information was not sufficiently complete for the purpose in view, and therefore the work of enlarging the 1 : 80,000 map to 1 : 50,000 was suspended in 1884. In 1900 the French Government, on the recommendation of General Berthaut, decided to commence an entirely fresh survey of the country, and upon this as a basis to publish a new map on the 1 : 50,000 scale. The nine sheets above mentioned, which include the neighbourhood of Paris, are the first instalment of this map to be issued to the public; and they certainly are most creditable productions, in general appearance and colouring resembling the sheets of the map of Algeria and Tunis published by the same department.

The map is graduated both in grade divisions and in the more familiar degrees, minutes, and seconds, and each sheet embraces 11 minutes of latitude and 22 minutes of longitude. It is projected in separate latitudinal zones, and thus the angle formed by the meridians varies.

The relief of the land is shown by contour-lines at 10-metre intervals. The levelling is referred to the older basis of Bourdaloüe, and to reduce this to the more recent zero a constant of $-0{\cdot}64^{m}$ must be applied.

The system of colouring adopted renders the map far more easily legible than the old 1 : 80,000 survey sheets, which are in black only. In the present map buildings and streets in towns are shown in red; water, blue; lettering and general communications and boundaries, black; parks and wooded lands, green; and contour-lines, brown.

When complete the map will consist of about 1100 sheets, and it is to be hoped that funds will be forthcoming to enable the Service Géographique de l'Armée to finish this important undertaking without unnecessary delay.

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: x.-27, Lesparre; xix.-32, Vellerangue; xxv.-26, Albertville. Paris: Ministère de l'Intérieur, Service Vicinal, 1906. *Price* 0.80 *fr. each sheet.*

These are new editions.

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilungen der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: (coloured) 269, Berlin; 294, Schöneberg. Berlin: K. Preussische Landesaufnahme, 1906. *Price* 1.50*m. each sheet.*

Ireland. **Bartholomew.**

Map showing the Surface Geology of Ireland. Reduced chiefly from the Ordnance and Geological Surveys under the direction of Sir Archibald Geikie, D.SC., LL.D., F.R.S., late Director-General of the Geological Survey. Topography by John Bartholomew, F.R.G.S. Scale 1 : 633,600 or 1 inch to 10 stat. miles. Edinburgh: John Bartholomew & Co., [1906]. *Price* 6*s. net. Presented by the Publisher.*

The amount of detailed geological information that is shown on this map is, considering its scale, surprising, and although there are nearly thirty different colour tints and symbols used, there is no confusion. However, the work is so minute, owing to the great reduction, that it requires careful inspection before it can be read intelligibly. As a specimen of colour tint printing it is excellent.

Turkish Empire. **Huber.**

Empire Ottoman. Division Administrative. Dressé d'après le Salnamé de 1899/1317 par Commandant R. Huber. Scale 1 : 1,500,000 or 1 inch to 23·7 stat. miles. 4 sheets. [Constantinople, 1906.]

ASIA.

Arabia Petræa. **Musil.**

Karte von Arabia Petraea nach eigenen Aufnahmen von Prof. Dr. Alois Musil. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. 4 sheets. Vienna: Alfred Hölder, [1906]. *Price* 15*m. Presented by the Publisher.*

So little survey work of any kind has been carried out in the region south and east of the Dead sea that Prof. Musil's map will meet with a ready welcome by all those interested in the region. This four-sheet map, based upon the author's route-surveys

and sketches, combined with other material, extends from the north end of the Dead sea to the Gulf of Akaba, and from the Mediterranean to 37° east of Greenwich. It certainly is the best map of the region yet published, notwithstanding the fact that many of the districts shown away from the routes depend upon nothing but the roughest sketches. The south-western part of the map is specially interesting at the present time, inasmuch as it includes the region of the Turko-Egyptian boundary between the Gulf of Akaba and the Mediterranean. Here, however, the map differs considerably, as regards the land features, from the results of the recent boundary survey, a reduction of which was published in the January number of the *Geographical Journal*.

Ceylon. **Surveyor-General, Ceylon.**

Colombo in 1904–5. Scale 1 : 3,168 or 20 inches to 1 stat. mile. 28 sheets. Mr. P. D. Warren, F.R.G.S., Surveyor-General, Ceylon. Colombo: Surveyor-General's Office, 1906. *Presented by the Government of Ceylon.*

China. **Topographical Section, General Staff.**

Province of Ho-Nan. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1906. *Price 2s. 6d. Presented by the Director of Military Operations.*

India. **Bartholomew.**

Thacker's Reduced Survey Map of India. By J. G. Bartholomew, F.R.G.S. Scale 1 : 4,435,200 or 1 inch to 70 stat. miles. Third Edition. Calcutta: Thacker, Spink, & Co.; London: W. Thacker & Co. 1907. *Presented by Messrs. John Bartholomew & Co.*

This is a new edition. As regards India itself, the work of revision appears to have been very carefully done; but in the adjoining regions of Tibet, the recent surveys of the British Expedition do not seem to have been taken full advantage of. However, it is a most useful general map, the value of which is increased by the excellent index to place-names, and the insets, plans, and maps dealing with special subjects.

Kashmir. **"Petermanns Mitteilungen."**

Karte des westlichen Kaschmir. Nach englischen Quellen. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. *Petermanns Mitteilungen*, Erganzungsheft No. 155. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

AFRICA.

Africa. **Langhans.**

Justus Perthes' Wandkarte von Afrika zur Darstellung der Bodenbedeckung. Bearbeitet von Paul Langhans. Scale 1 : 7,500,000 or 1 inch to 118·4 stat. miles. 4 sheets. Gotha: Justus Perthes, [1906]. *Presented by the Publisher.*

The basis of this map is the six-sheet map of Africa in the last edition of Stieler's Hand-Atlas. Upon this are superimposed six different and carefully selected tints, showing in a general manner the character of the vegetation and surface features of the land, the first of these, a dark green, indicating dense tropical forest, whilst the last, a light grey, shows sand and stone deserts and salt steppes. Political boundaries are also laid down, and at the bottom of the map there appears a set of small exploration inset-maps of Africa, showing the routes of the principal travellers at different dates from 1768 to 1900. Four other inset-maps, including one of the Cape Colony on an enlarged scale, are given on the south-west sheet, and along the top of the map runs a line of portraits, bearing more or less resemblance to fourteen of the principal African explorers. The railways on the map require a little revision, and the Mombasa-Uganda line is not shown by the symbol by which the other working railways are indicated, and gives the impression that it is only under construction. The map is accompanied by a most complete and useful index to place-names.

Although called a wall-map, the names and details are much too minute to be read at a distance. The surface-feature colouring is fairly bold, but even this can only be read by standing fairly close to the map.

Egypt. **Bartholomew.**

Bartholomew's Tourist's Map of Egypt and the Lower Nile. Prepared from the latest surveys. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Edinburgh: John Bartholomew & Co., [1906]. *Price 3s. net. Presented by the Publisher.*

This is a new edition of a map published in 1897. The principal map shows the Nile valley from the delta to Wadi Halfa. There are inset-plans of Alexandria and

Cairo, and another, on a small scale, of the whole of Lower Egypt and the Sinai peninsula.

German East Africa. **Spieth and Moisel.**

Karte des südlichen Teiles der Nguru-Berge. Auf Grundlage der neuen Aufnahmen von Bezirksamtmann Spieth 1904–1905 und mit Benutzung der veröffentlichen Karten konstruiert und gezeichnet von H. Nobiling unter Leitung von M. Moisel. Scale 1 : 150,000 or 1 inch to 2·4 stat. miles. *Mitteilungen aus den deutschen Schutzgebieten*, Band 19, 1906. Berlin: E. S. Mittler & Sohn, 1906. *Presented by Herr Max Moisel.*

Morocco. **Service Géographique de l'Armée, Paris.**

Carte du Maroc. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. Sheets: 2, Tangier; 4, Fez. Paris: Service Géographique de l'Armée, [1906]. *Price 1 fr. each sheet.*

Two sheets of a new map of Morocco on a larger scale than any map hitherto published. Together they include the region between 32° 20′ N. lat. and the Mediterranean, whilst in longitude they extend from the Atlantic to Melilla. As no systematic survey has been made, with the exception of the coast-line, the sheets have been solely compiled from route-sketches of varying merit, and in many districts it is evident that the information can only have been very approximate.

Orange River Colony. **Surveyor-General, O.R.C.**

Map of the Orange River Colony and Basutoland, with surrounding portions of the Cape Colony, Transvaal, and Natal. Scale 1 : 740,000 or 1 inch to 11·7 stat. miles. Compiled from the best available information in the Surveyor-General's Office, Bloemfontein, O.R.C., 1906.

A general and somewhat highly coloured map of the Orange River Colony. In addition to the map itself, useful tables are given, as insets, of the population and area of different districts. Although decidedly sketchy in appearance, such information as is found on the map has been taken from the latest material, the population tables being based upon the census of 1904.

Togo. **Sprigade.**

Karte von Togo. Bearbeitet von P. Sprigade. Scale 1 : 200,000 or 1 inch to 3·1 stat. miles. Sheets: D-1, Kĕte-Kratschi; D-2, Atakpáme. *Mitteilungen aus den deutschen Schutzgebieten*, Band 19, 1906. Berlin: E. S. Mittler & Sohn, 1906. *Presented by Herr Max Moisel.*

AMERICA.

Alaska. **U.S. General Land Office.**

Alaska. Compiled from the official Records of the General Land Office, U.S. Coast and Geodetic Survey, Geological Survey, Canadian and other sources, under the direction of Frank Bond, Chief of Drafting Division, G.L.O., 1906. Scale 1 : 3,801,600 or 1 inch to 60 stat. miles. Washington: Department of the Interior, General Land Office, 1906.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 20, Souris, revised to October 8, 1906; 70, Moose Mountain, revised to October 13, 1906; 117, Red Deer Forks, revised to November 19, 1906; 119, Regina, revised to November 3, 1906; 120, Qu'Appelle, revised to October 26, 1906; 121, Riding Mountain, revised to October 2, 1906; 122, Manitoba House, revised to September 29, 1906; 123, Fort Alexander, revised to September 21, 1906; 166, Sounding Creek, revised to October 15, 1906; 170, Yorkton, revised to October 30, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Ottawa.**

Standard Topographical Map of Canada. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets 1 N.W. and 1 N.E., Guelph, Ontario. Ottawa: Department of the Interior, 1906. *Presented by the Department of the Interior, Ottawa.*

GENERAL.

German Colonies. **Sprigade and Moisel.**

Grosser Deutschen Kolonialatlas. Bearbeitet von Paul Sprigade und Max Moisel Herausgegeben von der Kolonial-Abteilung des auswärtigen Amts. Lieferung 5. Sheets: 1, Erdkarte zur Uebersicht des deutschen Kolonialbesitzes; 2*b*, Togo

(südliches Blatt); 16, Usumbura, Deutsch-Ostafrika; 19, Udjidji, Deutsch-Ostafrika. Berlin: Dietrich Reimer (Ernst Vohsen), 1906. *Price* 4*m. each part. Presented by the Publisher.*

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Parts 16 and 17. London: George Newnes, Limited, [1906]. *Price* 6*d. each part. Presented by the Publisher.*

The maps contained in the above-mentioned parts are as follows:—Part 16: 29, Postal map of the World, 1907; 30–31, Map of the World, showing telegraphic communication; 32, Industrial map of the British Isles; 38–39, Industrial map of Central Europe; 40, Agricultural and industrial maps of India.—Part 17: 67, Map of the World, showing meat-exporting and importing countries; 13, Copper districts of the World. These parts also contain continuations of the Commercial Gazetteer.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and 105,000 references. Parts 4 and 5. London: The Amalgamated Press, Limited, 1906. *Price* 7*d. each part.*

These parts contain the following maps: Part 4. Nos. 31–32, The Scottish Lowlands; 61–62, The Alps (physical); 113–114, Indian Empire, industries and communications. Part 5. Nos. 15–16, Europe, industries and communications; 185–186, South America, general map; 195–196, Pacific ocean, cables and ocean depths.

World. **Johnston.**

The M.P. Atlas. A collection of maps showing the commercial and political interests of the British Isles and Empire throughout the World. Edinburgh and London: W. & A. K. Johnston, 1907 [1906]. *Price* 25*s. Presented by the Publisher.*

This atlas consists of forty-one plates, which contain altogether fifty-three maps. These consist of a selection of the general maps of continents, and those which are supposed to have special reference to the British Empire, from the publishers' well-known Royal Atlas, supplemented by a number of physical and commercial maps and charts, many of which have been specially drawn for this atlas. The Royal Atlas maps can generally be easily distinguished from the others by the greater fineness of the execution of their outline and lettering. Throughout the atlas the maps vary much in merit, and in some cases, such as Northern India and Abyssinia, which are taken from the Royal Atlas, although attempts have been made at revision, the general physical features in parts are so much out of date that it is to be hoped that in another edition entirely new maps may be substituted. As regards the physical maps, while some are certainly rough productions, one or two, such as the Bathy-orographical and Rainfall maps of the British Isles, are most creditable specimens, being clearly drawn and carefully printed in colours. Many of the maps would have been improved in appearance if less colour had been used; this is specially the case where inland waters, boundary-lines, and territorial divisions are concerned. No index to place-names is given, which greatly detracts from the value of the atlas for purposes of reference.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas verkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Pertlres' Geographischer Anstalt in Gotha. Lieferungen 31–34. Gotha: Justus Perthes, 1906. *Price* 6 *pf. each part.*

Parts xxxi. and xxxii. (in one) contain the following maps: 28, France, 1:1,500,000, sheet 2; 51, Balkan peninsula, 1:1,500,000, sheet 1; 60, Arabia, 1:7,500,000; 89, United States, 1:3,700,000, sheet 4. Parts xxxiii. and xxxiv. (in one): 20, Austria-Hungary, 1:1,500,000, sheet 4; 48, Russia, 1:3,700,000, sheet 5; Australia, 1:5,000,000, sheet 2. Contains a continuation of the alphabetical index to place-names. Little has been done in the way of revision of these sheets, and they are much as they appeared when last issued. All the maps in these parts are dated 1907, but this is hardly correct, since they were published towards the end of last year.

World. **St. Martin and Schrader.**

Atlas Universel de Géographie construit d'après les sources originales et les documents les plus récents, avec un texte analytique. Ouvrage commencé par M. Vivien

de Saint-Martin et continué par Fr. Schrader. Sheet 77, États-Unis (Région du nord-est). Paris: Hachette et Cie., 1906. *Price 2 fr. each sheet.*

World. **Woeikow.**

Verteilung der Bevölkerung auf der Erde. Von A. Woeikow. *Petermanns Mitteilungen*, Jahrgang 1906, Tafeln 17–20. Gotha: Justus Perthes, 1906. *Presented by the Publishers.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November, 1906. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
3613		The World:—Mean lines of equal vertical force, 1907. 1*s.*
3564	m = 6·9	Scotland, west coast:—Loch Kishorn and the approaches to Loch Carron. 3*s.*
1448	m = {2·0, 3·9}	Spain, south coast:—Acebuche point to Chullera point, including Gibraltar bay. Plan:—Algeciras roads. 3*s.*
3609	m = 6·3	Sardinia, north-east coast:—Port Terranova. 2*s.*
3583	m = 2·9	Newfoundland:—Bay of Exploits, sheet 5. 3*s.*
3610	m = 3·6	Magellan strait:—Willes, Harriss, and Fox bays. 2*s*
3611	m = 2·8	Plans on the south coast of Sumatra:—Zutphen islands, Kiluang bay. 2*s.*
992	m = 1·7	Japan:—Akkeshi wan. 2*s.*
3602	m = {5·9, 4·0}	Anchorages in Yezo island:—Mombetsu anchorage, Mori roads. 2*s.*

New Plans and Plans added.

98	m = 1·35	Plans on the south coast of Cuba. Plan added:—Puerto Francés. 2*s.*
1364	m = 0·99	Africa, west coast:—Cape Mesurado to Baffu bay. New plan:—Junk bay. 3*s.*
71	m = 2·5	Bay of Bengal:—Madras to Calimere point. New plan:—Pondicherri anchorage. 4*s.*
1495	m = {4·4, 5·9, 5·0}	Japan:—Aburatani bay to Ando zaki. Plans added:—Shichirui ura, Yunotsu ura, Yesaki ko. 3*s.*
2198	m = {2·9, 3·0}	Harbours and anchorages on the north coast of Nipon. Plans added:—Yezumi ura, Sagi ura. 2*s.*
3003	m = {1·75, 2·95, 6·0, 1·92, 1·75}	Japan:—Ando zaki to Otose zaki, including Sado island. New plans:—Niigata ko, Ogi ko. Plans added:—Tsukumo wan, Yebisu ko, Naoyetsu ko. 3*s.*
3131	m = 10·0	Anchorages in New Hebrides islands. Plan added:—Narovorovo.

Charts Cancelled.

No.	Cancelled by	No.
1448 Spain, south coast:—Gibraltar bay, Algeciras roads.	New chart. Acebuche point to Chullera point, including Gibraltar bay. Plan:—Algeciras roads	1448
2056 Sunda strait and approaches:—Plan of Kiluang harbour on this sheet.	New plan. Kiluang bay on chart	3611
993 anchorages in Yezo island:—Plan of Mori roads on this sheet.	New plan. Mori roads on chart	3602
992 Japan:—Akishi bay.	New plan. Akkeshi wan	992

by triangulation with that of Zanzibar established in 1882 by Sir David Gill.

Detailed mapping was of course required along the boundary itself, and when favourable opportunities occurred some further topographical work was executed.

It must be recollected that the journey we were about to undertake from the Victoria Nyanza to Laitokitok was across unknown country, a distance of 273 miles as the crow flies. Joseph Thomson in 1883–4 had travelled along the old caravan route from Laitokitok to Nairobi. The route had been crossed at right angles by travellers following the Rift-valley, Count Teleki and von Höhnel in 1887–1888, Schöller in 1896–1897, and Neumann in 1894. The latter had, indeed, made his way from the Rift-valley to the Victoria lake, but he had not followed the boundary. In 1903 Major Burnham had crossed from Nairobi to the neighbourhood of Karungu, but he had only been so far south as the boundary in the vicinity of the Victoria lake. From all these sources and from others, including my own work in 1897 and Commander Whitehouse's excellent chart of the lake, we compiled a map. It had marked on it the Victoria Nyanza, and the positions of some hilltops between the Rift-valley and Kilimanjaro, but for the rest the most marked characteristic of our compilation was the exiguous amount of information to be found on it. Vague stories of water scarcity, which turned out to be not without foundation, and vaguer reports as to terrible natives reached us from British and German sources. The Kisii were known as a tribe who habitually raided the Southern Wakavirondo, whilst the position of their country was supposed to be on the boundary. In point of fact, we had no intercourse at all with the Kisii, who dwell some 30 miles at least north of the Anglo-German boundary. Mr. H. Horne, at that time assistant-collector at Karungu, was the first to locate them at all accurately, obtaining for me information, confirmed by later travels of Lieut. J. Leveson-Gower, as to their whereabouts. Some accounts exaggerated the power and numbers of the Masai whom we should meet; but I had had sufficient experience of that once powerful nation near Nairobi to be confident that we should have no great difficulty with them. The Masai have many faults which have been sufficiently recounted by others, whilst I have ever found them brave and loyal friends.

Water, I knew, was scanty during the latter half of the journey. We could only hope we should find it in the earlier part, and took with us a good supply of paraffin-tins to allow us to carry it if necessary. Water was often hard to find, especially in parts where we had not good guides. Our precautions turned out to be sufficient, and we had the good fortune to be helped by heavy rains through the most difficult country.

Our transport consisted of native porters, helped by some donkeys.

In spite of expense, porters are still the best transport through unknown regions in East Africa.

With a caravan of about five hundred men, food and transport became a matter of great importance. Very little could be obtained on the way. For twelve marches up to the Rift-valley my food base was Karungu; later, Nairobi, Kiu, and Voi, on the Uganda railway, became in turn bases. After the neighbourhood of the lake was left behind food had to be transported for our use an average

SKETCH MAP OF PART OF EAST AFRICA TO ILLUSTRATE THE PAPER BY CAPT G. E. SMITH R.E.

distance of about ten marches. Never was the distance less than five marches.

A porter's load is 60 lbs., or forty rations of food; but allowing for damage by weather, loss by rats, petty thefts, etc., and the extra food necessary in the higher and colder parts, a load averages little more than about thirty rations, whilst it must not be forgotten that while operating at such a place as Ndasegera, eleven long marches from Karungu, our base, and nearly as far from Nairobi, the food of the porters bringing up the loads has to be found from what is carried. Thus a load of food costing Rs.2 at Karungu, by the time it reached Ndasegera cost nearly Rs.10 on account of transport.

It will be readily understood that the supply of a caravan eating about twenty-four loads a day, which had to be transported so many marches, required constant attention and anxiety, and that unforeseen delays might cause grave discomfort or even danger to the men. When shifting the line of supply, some months' notice was required to make the necessary arrangements.

A description of the country between Kisumu and Karungu has been published in papers of Mr. Hobley, of the East African Administration. The additional information obtained by me chiefly consists in the determination of the co-ordinates of various points in that part, which will be found by cartographers in an appendix. It may be

A TYPICAL SCENE, NDERE.
(*Uhlig, photo.*)

noted here that my value for the level of Lake Victoria is 3737 feet, which, depending as it does on series of reciprocally observed vertical angles, is the most reliable value yet obtained. The determination by the railway survey was 3726 feet, so that the difference is not great.

Mohuru peninsula itself, our starting-point on the lake, has several rocky hills on it, covered with large granite boulders. It had some prosperous villages growing Indian corn and millet. The inhabitants call themselves Wasuba, and are a branch of a tribe living further south. When we were at Mohuru, just before the harvest, the chief employment of the inhabitants was that of frightening the birds from their crops. They build numerous platforms, about 10 feet high, to

which they repair in the morning with a good supply of stones and a sling. Men, women, and children wear no clothes, so that the act of

THE MARA RIVER, OR NGARE DABASH, IN HALF FLOOD.

slinging sets off their figures to the best advantage. They also employ a system of cords attached to sticks about the height of the tops of their crops, which they agitate from their perches with the same object, but with remarkably small success.

In south Kavirondo quails are plentiful and much prized by the natives. They catch them alive in small traps, and keep them in cages about the size of a cricket-ball, which they hang one below the other from poles set up in their villages. It was said that the usual fee paid by the bridegroom to the bride's parents is twenty-three quails, an explanation of the trouble they take in catching them.

The preliminary work up to the starting-point of the boundary in Mohuru peninsula involving the measurement of two bases, careful latitude and azimuth observations, and the observation and computation of about 90 miles of triangulation was finished towards the end of July.

Proceeding along the boundary from the shores of the lake for

about 20 miles to Gurribe hill, thorn bush and veldt without inhabitants are passed. Round Gurribe hill streams of water become plentiful, and just north of the boundary the tribe of Suna, akin to the Wakavirondo, owning Gurago as their chief, is met with. They grow sweet potatoes, maize, etc., and a small quantity of tobacco and Indian hemp. They keep goats, which live in their huts at night, but have only a few cattle.

A few miles further on, some small rocky hills are inhabited by Butende. They conceal their huts among the rocks. In appearance and physique they show signs of kinship to the Masai. Their dialect appears to be very like the Suna language. The young men take much pains over their toilettes, doing their hair in elaborate styles, and wearing fine iron chains and beads round their necks. They cultivate and keep cattle.

On the German side inhabitants continue 20 miles further; but north of the boundary, after Butende only wandering bands of Masai and Wandorobo are met. It is not possible to distinguish very clearly between the two. Masai, when for any reason they become impoverished, take to Wandorobo hunting habits, and mingle on equal terms with the latter. The true Wandorobo appear to be the remains of an earlier hunting tribe widely spread. The evidence of language is as yet uncertain. Masai often speak the Wandorobo language, whilst as far as my experience goes, Wandorobo always speak Masai. But I have never heard of any European who could speak the language of

THE GWASO NYIRO, NEAR THE NATRON SEE.

the Wandorobo at all. Dr. Chavallier has told me that they resemble in appearance the Waboni of Jubaland. If language corroborates this

NGAI. STILL ACTIVE.
(*Uhlig, photo.*)

view, though few in number this hunting tribe ranges over a very wide country.

From Butende the levels continue to rise until the Isuria escarpment is reached at an altitude of about 6200 feet. Grass land with patches of forest have succeeded on the higher land to the thorny velt nearer the lake, whilst water is still fairly plentiful. Judging from the improvement in the bullocks which we took with us as an emergency reserve of food, this part is excellent for cattle, whilst game abounds. A glance at the map will show that the Isuria escarpment runs north-east and south-west, forming the western wall of the wide valley of the Engare Dabash or Mara river, which, rising far up northwards in the Mau highlands, crosses the boundary 76 miles from the lake, and, taking a wide sweep to the southwards, debouches in German territory not far south of Shirati. The view from the top of Isuria is very fine, range after range of hills rising towards the continuation southwards of the Mau. The Engare Dabash itself is a considerable stream 50 yards wide and 20 feet deep during the rains, in the dry season fordable in some places. The plains on both sides of it are not well watered, all the streams on the Isuria escarpment flowing south or west. Dry river-beds, or "olkaju," join it from the east, but as a rule the water can only be obtained in certain places by digging, until the mountains of Kuka are reached, where small streams are met which soon lose themselves in the plains.

The country continues to rise for some distance up to the watershed

dividing the water system of the Mara from the Rift-valley. To the southward the escarpment of the Rift-valley rises to its greatest height at Ndasegera, 8300 feet, and the high country of Lasiebek, whilst to the north Osubogo Lo Loiitai, of 8000 feet, forms a considerable mass, noted chiefly among the Masai for the fine manes carried by its lions. There is water on this high tableland, but, not having good guides, it was not easy to find, and Lieut. Leveson-Gower had several very hard marches in preparing the way for us in front.

The slopes of the western escarpment, where not too precipitous for trees to grow, is clothed with a fine forest, in which the juniper and other trees well known further north are met with. Most of the country we came through is uninhabited, not because the land is not good—much of it is most excellent grazing-ground—but because it has been Masai country. The Masai, under Sindeo, used to inhabit this region, spreading farther south into German territory. Lenana, Sindeo's brother, occupied the country farther north, the district near Nairobi being his headquarters. Both these brothers claimed supremacy over the whole of the Masai, and their respective partisans were continually fighting. Sindeo was under the disadvantage of not

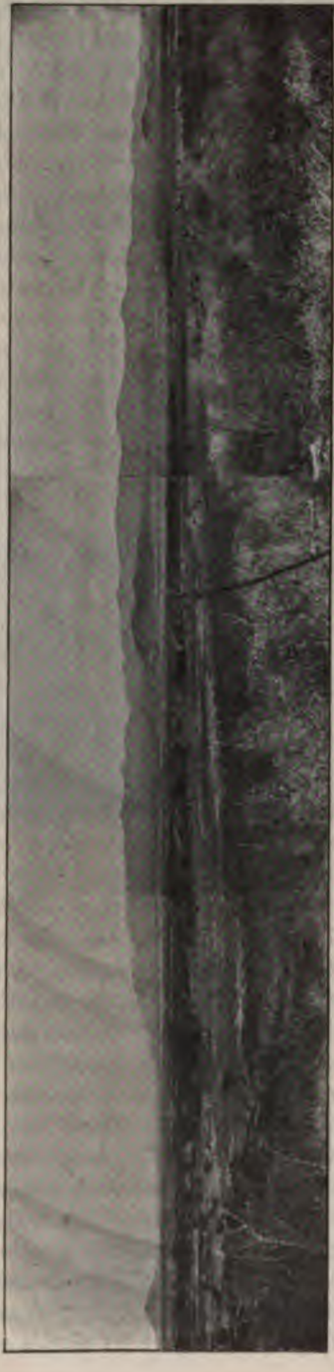
FOREST VEGETATION AT 6500 FEET.
(*Captain Behrens, photo.*)

being on friendly terms with the German Government. On one side was Lenana demanding his submission, on the other he was constantly at war with the Germans. He is now completely beaten,

and lives in English territory under the eye of Lenana, and much of the country near the boundary is depopulated.

There is plenty of evidence that formerly the Masai were much more numerous and formidable than now is the case, and the Masai themselves attribute the cause of their decline, in addition to their wars just mentioned, to the cattle plague (rinderpest), which devastated their country in 1888 on its way southward towards South Africa, and to a bad attack of small-pox, which followed in the train of the famine caused by the wholesale death of their cattle.

From the top of the escarpment the drop is abrupt, with a second escarpment lying like a shelf at its foot. Good streams water its valleys, the springs of which are not usually very high up. The plain below is at the comparatively low level of about 2000 feet, and is consequently very hot. The Ewaso Nyiro and the numerous streams descending the western escarpment are kept to the western side of the floor of the Rift-valley by some minor features, and all flow into the German Natron See, where the evaporation on its hot and shallow expans s is sufficient to account for the existence of no exit from its basin. The Natron See is also fed by numerous small springs impregnated by carbonate of soda. When first I saw it the area of water was only some 10 square miles in extent, but after the January and



THE LOLGOROSSIEN MOUNTAINS AND LANGARALORIGA, LOOKING NORTH-EASTWARDS.
(Captain Behrens, photo.)

February rains it had spread over about 200 square miles of flats. The deposits in this lake contain much carbonate of soda, but the large quantities of sediment brought down by the various rivers when in spate probably prevent them from being particularly pure. Forty miles to the south of it rises the volcano of Doinyo Ngai, said by the Masai to be still active at times—a report which I believe has been confirmed by the observation of German travellers. The slopes of it often shine like snow in the sun with the incrustations of soda upon it.

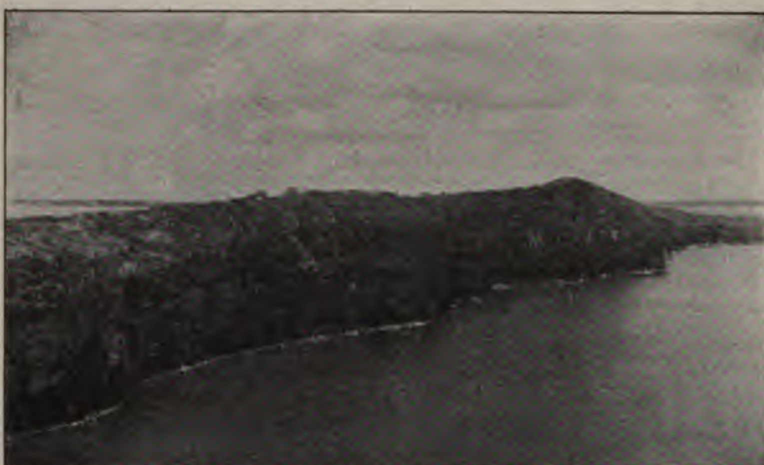
The Magadi, or soda lake, of the East African Syndicate forms a separate water system, into which only one small stream of fresh water flows. Springs of soda-saturated water ooze from below the rocks which bound it, whilst two considerable hot streams saturated with soda flow into it from the south. The lake, some 100 square miles in extent, is never more than a few inches deep, and considerable expanses of it are often uncovered. It forms a natural evaporating-pan, and the soda dug from it is remarkably pure and abundant. The dense waters of the lake and their shallowness cause the lake in that breathless region to retain or regain an unruffled surface, so that perfect reflections of the precipices to the west of it are generally seen. The soda, only differing I believe from washing-soda by the amount of water of crystallization, has an exceedingly bad effect on boots and on the porters' feet, making the former crack and the latter exceedingly tender. Thousands of flamingoes and wading birds are to be found on it, hunting for a kind of small fish which lives in the mud.

On the slopes of the escarpment west of the Magadi lake live the Nguruman Masai. The country is well chosen on a plateau between the main escarpment and the floor of the Rift-valley, and it is well watered by permanent streams from the escarpment. Unlike other Masai, these people cultivate sweet potatoes and millet, and understand a primitive form of irrigation. They keep sheep and goats, but have no cattle; are peaceable and not interfered with by other Masai during intertribal fights. They claim to supply the whole Masai tribe with calabashes. Because of their peaceful habits and from the fact that they live from cultivating the soil, they are rather despised by the rest of the Masai; but they are a definite branch of the main tribe, and send their more important disputes into Nairobi for Lenana to settle. They are not truthful like the other Masai, the effect perhaps of their low esteem among their fellows.

In German territory, some distance south of Ndasegera, is an inhabited country called Losailik, or Sonyo. The latter name is an instance of the difficulty of correctly naming places when the dialect of the guide is not well known. It means "Thingumabob," and was doubtless the answer of a guide who had forgotten the name. One mountain in those regions figured on the map in the Masai equivalent for "I forget," Atorigini. I cannot even now be certain that some of my

place-names are accurate. I had to alter one, viz. Olotoiboiologunya, which I found really meant "Your boy has gone on ahead." Since then my place-names have been edited by Mr. A. Hollis, Secretary to the East Africa Administration, and Lieut. Leveson-Gower, who are the leading authorities on the Masai language.

The floor of the Rift-valley, especially to the eastern side, is broken by numerous dykes of hard lava running parallel to one another north and south. Between them run trough-shaped valleys bounded by the dykes, which are often precipitous for miles. These characteristic dykes extend from the German Natron See to the south without interruption as far north as the Kedong river west of Kikuyu, a distance of



LAKE CHALA.
(*Captain Behrens, photo.*)

more than 100 miles, and may be traced again, though less markedly, from Naivasha to Baringo. They are usually on the eastern slopes of the Rift-valley. They are never seen on the western escarpment, which is much more abrupt in its descent. The general conditions would be met by the hypothesis of one general line of fault of great extent on the western side of the valley. If that side was uplifted, and the present floor of the valley depressed and forced under it, one would expect as a consequence the opening of extensive parallel cracks northward and southward on the eastern slopes. Extensive crack eruptions of lava might result, which still remain in the form of dykes, whilst most of the overflow above has been denuded to form the very flat floor of the Rift-valley. The suggestion is confessedly made with incomplete evidence.

Among these dykes water is scanty, especially in the region of the Magadi lake. No permanent water was found in crossing from the Ewaso Nyiro to Lanjoro Dis, about 35 miles—in the dry weather a very arduous march, necessitating the carrying of water. Lanjoro Dis is a small spring just on the German side of the boundary. It is situated on the side of the Kilibei hill forming the eastern escarpment of the Rift-valley, which is here less regularly marked than usual. There are springs of water in various places in this region, but they are not plentiful, and their permanence is doubtful in very dry seasons. The plateau of the Matumbato Masai is an extension southwards of the Athi plains near the railway; but it is more broken up by hills and mountains rising from it, of which the most considerable is Erok, or Ol Doinyo Orok, with the boundary passing over its southern slopes. Ol Longito, or Ol Legishun, faces it with an enormous overhanging mass of rock forming its northern crest, whilst beyond, Kilimanjaro the highest mountain in Africa rises to 19,328 feet.

Good grass covers the country, which is only wooded in the valleys or on the hills, Erok and Kilimanjaro having considerable forests. Water is not plentiful, springs being seldom found except near the higher hills, and even on the slopes of Kilimanjaro towards the north-west, water is scarce. The levels fall from near the Rift-valley towards the swamps north of Kilimanjaro, which vary very much in extent. The wide dry beds leading thither become torrents in the rains. They form a separate water system, not communicating above ground with the Tsavo river, which rises from springs to the north-east of Kilimanjaro. The swamps are saline, but in the rains drinkable.

Long marches from water to water were the rule, until the rains came. Fortunately they began a month earlier than usual, so that the worst country between Erok and Kilimanjaro was turned from a thirsty desert into a sea of mud, which, although unpleasant and tiring to wade through, relieved us of the difficulties of thirst.

The lower slopes of Kilimanjaro are open grass velt, with thorn-bush in places, and are studded with small hills, whose crater shape generally shows their volcanic origin. Rough lava rocks among the long grass often make the velt very bad to traverse. The forest on the mountain begins at a level of about 7000 feet, with an upper limit of nearly 10,000 feet. Streams are usually found in it, but often disappear beneath the lava bed, to reappear again in spring near the plain. But it is not till near Laitokitok that water is plentiful. Below the mountain to the eastwards the Seringeti plain and the plain of the Tsavo river are covered with dense thorn jungle, and the sansevera or kongi helps to make impenetrable thickets with its spiked leaves, stiff enough to pierce a pigskin gaiter. The beautiful crater lake called

Chala, first described in an official despatch as "an irregular quadrilateral triangle with its corners rounded off," and first circumnavigated by Mrs. French Sheldon, is situated to the north-east of the Taveta station.

The eastern terminal at Laitokitok, on the northern slopes of Kilimanjaro, was reached early in March, 1905, and the work of the commission up to that point was completed in July of the same year. It will be remembered that the problem before us had been to join two points 270 miles apart on the Earth's surface by a geodetic line. Although international arrangements for adjusting any discrepancy had

LAKE JIPÉ.

(*Captain Behrens, photo.*)

been made, it was a point of considerable interest what that discrepancy would be. The latitudes of the assumed positions at the two ends were, of course, not likely to be greatly in error, but the longitudes were not previously connected with one another. The western terminal longitude was deduced by our triangulation from that of Kisumu, which had itself been fixed by telegraphic exchange of time-signals from Mombasa. The longitude of Mombasa was taken from the Admiralty chart, and depended on chronometer run from Zanzibar. The longitude of Laitokitok was fixed by Consul-General C. S. Smith in his boundary survey of 1892, his longitudes depending on the value assigned to a hill called Jumbo on the Admiralty chart, whose position had been fixed by cross

azimuths from two positions whose longitudes depended on chronometer runs.

The distance at right angles to our geodetic line by which we missed the east terminal was about 95 yards, whilst the discrepancy in longitude was 6″·6 of arc, or about half a second of time. The smallness of this discrepancy confirmed in a remarkable manner the general accuracy of the previous work of various different authorities. Hauptmann Schlobach's triangulation, which was independently observed and computed, never differed from mine by more than about 100 feet.

After July, 1905, some additional work was done in the region of Taveta, again confirming the accuracy of Consul-General C. S. Smith's trigonometrical points. My triangulation, in conjunction with that of Hauptmann Schlobach, was carried on to the Usambara hills, where it was joined up with the German Government Survey, which is of a high order of accuracy.

From the southern end of this survey a few additional triangles were observed connecting it with Zanzibar, whose longitude was established by Sir David Gill during the longitude operations connecting Capetown and Aden. The whole work was complete at the end of December, 1905.

The geographical results of my expedition include a series of triangles without break from Zanzibar to Kisumu, and are themselves connected with Lieut.-Colonel Delmé-Radcliffe's chain from there to the intersection of the Anglo-German and Anglo-Congo boundaries west of the Victoria lake.

Sir David Gill assigns a probable error of ±0·5 second of time to his Zanzibar determination of longitude. I consider that the longitude error over the whole of the long chain described should be less than ±1 second of time.

I cannot close my account without acknowledging the assistance that I have received in preparing this paper, especially with regard to photographs for lantern slides, from the officers who were under my command. In Africa my German colleagues gave me every assistance and constant hospitality. The officials of the East African Protectorate and of Zanzibar were most kind in their help and in exercising the boundless hospitality of the remoter parts of the British empire.

APPENDIX.

The instruments used for trigonometrical and astronomical work were two 6-inch and one 5-inch Troughton & Simms transit micrometer theodolites. Plane-tables were used for mapping; 400-feet steel tapes were used for base

measurements. Temporary tripod beacons were erected at the main trigonometrical points. In all main triangles all angles were observed.

The constants of the Survey of India and the formulæ of pages 69–72 appendix, Auxiliary Tables, Survey of India were employed.

Azimuths were observed at seven stations, with an average probable error of $\pm 1''{\cdot}3$, with values varying from $\pm 2''{\cdot}6$ to $\pm 0''{\cdot}2$. Latitudes were observed at seven stations, with an average probable error of $\pm 0''{\cdot}4$, with values varying between $\pm 0''{\cdot}6$ and $\pm 0''{\cdot}1$. Four bases were measured, with probable errors of 1 : 200,000; 1 : 100,000; 1 : 154,000, and 1 : 645,000; mean triangular error = 6″.

A consideration of the errors tabulated will show that the work done is good secondary triangulation. Especially should be noticed the good agreement between astronomical and triangulated latitudes at Vilima Viwili. At both Mohuru and the latter place there is no *à priori* reason for expecting local attraction. At Vilimi Viwili the earlier work of 1892 led me to expect this result. It does not appear that any general readjustment of the triangulation is called for; indeed, nothing short of a discussion by the Method of Least Squares would give more reliable results. It is generally agreed amongst geometers that only the most accurate geodetic work possible with the largest instruments is worth the expensive and laborious process of such adjustment.

Table I., showing on what Base, Azimuth, and Latitude Values the Different Sections of the Triangulation were computed.

Names of ends of sections.	Base.	Azimuth.	Latitude.
Kisumu, Mohuru	Mean of Kisumu and Schirati each meaned with Germans.	Mohuru meaned with Germans.	Mohuru meaned with Germans.
Mohuru, Kebololet	Ditto.	Ditto.	Ditto.
Kebololet, Shombole	Ditto.	Kebololet.	Ditto.
Shombole, Kilibei	Guaso Nyiro Mosquito Camp.	Mosquito Camp.	Ditto.
Kilibei, Laitokitok	Ditto.	Above azimuth meaned with Germans.	Ditto.
Laitokitok, Vilima Viwili ...	Above length meaned with Germans.	Observations at Laitokitok meaned with Germans.	Above meaned with Germans.
Vilima Viwili, Schagein ...	Ditto.	Ditto.	Ditto.
Schagein, Tongwe	German Government Survey.	German Government Survey.	Ditto.
Tongwe, Zanzibar	Ditto.	Observed Genda Genda meaned with German Government Survey and observed at Zanzibar.	Ditto.

Name.	Latitude S.	Longitude E.	Height in feet.
	° ′ ″	° ′ ″	
Kuka	1 42 59·87	35 15 1·85	7161
Leganisho	1 35 49·78	35 24 3·98	7247
Mundorosi	1 53 2·74	35 26 49·84	7621
Ol Albwa	1 40 19·29	35 30 39·28	7513
A	1 47 22·36	35 41 48·92	7707
Ndasegera	1 57 58·97	35 42 41·60	8303
Escarpment	1 50 56·66	35 57 5·69	7677
Sambu	2 8 30·33	35 56 51·28	6383
Shombole	2 7 33·16	36 5 45·74	4850
Base, North, Guaso Nyiro, observation spot	2 0 59·89	36 8 25·46	2048
12	2 2 21·39	36 20 56·18	3181
Killibei	2 22 21·76	36 26 25·34	6973
Luanji	2 13 19·29	36 33 45·88	6612
Erok	2 29 38·32	36 44 54·92	8386
Elemobarasha	2 13 1·96	36 52 45·74	6890
Enoiiti	2 46 36·72	37 7 2·47	4207
Meshanai	2 32 17·16	37 10 53·90	4010
Endoinet	2 55 19·16	37 25 33·04	7167
Naduyatui	2 42 30·18	37 29 20·54	4134
Camp, observation spot Laitokitok ...	2 56 13·41	37 31 16·08	5562
East Terminal (T. 1)	2 57 19·32	37 31 16·01	5881
Longailil	2 55 46·99	37 33 8·34	5206
Longaria	2 56 2·48	37 35 31·06	5222
Losoiito	2 42 11·59	37 37 7·58	4324
Nagavai	3 0 47·00	37 44 6·34	4001
Soiiti Sambu	2 44 57·56	37 49 29·56	4242
Y	2 59 11·19	37 59 1·58	2691
Losoiito (Mog. 9)	3 14 46·83	37 52 54·03	4021
Chala (Nakurtu)	3 19 25·10	37 41 3·15	3692
Ndui ya Warombo	3 21 48·18	37 43 48·12	3083
El Oldorobo	3 23 20·97	37 47 9·42	3098
Latema	3 24 12·35	37 37 3·52	3660
Mokinni	3 29 50·87	37 38 8·85	3458
Vilima Viwili	3 34 44·57	37 47 53·37	3105
Erakatawya	1 25 37·11	34 45 43·84	6185
Aiburr	1 30 21·0	34 56 53·0	5177
Loldobaih	1 30 56·0	35 3 1·0	5252
Losegin	1 38 51·30	35 19 46·08	6843
88	2 26 49·05	36 33 31·47	6976
Melwaioni	2 22 19·91	36 55 32·04	5295
Lemomo	2 46 24·89	37 15 5·69	4517
Engero	2 48 36·46	37 24 45·95	5124
Songai (not plotted)	1 0 1·58	34 2 32·28	—

Intersected points.

Jipe S.	3 40 32·0	37 37 57·0	2342
Usange	3 41 19·46	37 38 1·91	6324
Ndea...	3 51 51·09	37 53 41·39	4638
Kwizu	4 6 32·05	37 52 24·47	6257
Tussa	4 9 24·26	38 5 7·29	4201
Vunta	4 28 51·16	37 57 37·35	6631
Schageïn	4 30 57·14	38 17 33·08	7320
Segera	5 18 38·11	38 33 12·08	—
Tongwe	5 18 21·45	38 43 36·25	—
Kofi	5 28 50·0	38 21 46·0	—
Genda Genda	5 34 16·57	38 38 40·22	—
Kondussi	5 48 8·67	38 35 11·06	—

Name.	Latitude S.	Longitude E.	Height in feet.
	° ' "	° ' "	
Zanzibar (Z.1)	6 9 45·80	39 11 4·72	—
Ugisero	1 1 54	34 6 3	3928
Mo. 7	1 1 23	34 3 7	3883
Nun. 18	1 11 11	34 10 24	4913
Mo. 1	0 59 4	34 4 51	4065
Taveta Flagpost	3 23 51	37 40 32	2511
78	2 29 11	36 44 54	8097
1	3 51 50	37 53 41	4623
2	3 50 33	37 50 33	4093
3	3 51 48	37 48 34	5159
4	3 51 10	37 47 55	4857
Kiambo I.	0 40 21	34 17 43	5390
Nun. 19	1 11 50	34 7 34	—
Taragut	1 15 40	34 27 54	5628
Mog. 12	3 9 30	38 1 40	4554
Lessengin (Mog. 15)	3 0 23	38 9 5	5990
86	2 58 37	37 59 39	3191
Sengin	2 54 56	37 52 38	3723
b.	2 48 28	37 53 15	3939
Mog. 10	2 47 29	37 58 27	5992
Kiambo II.	0 43 30	34 13 5	5784
Kiambo III.	0 46 49	34 8 11	5198
Tigra	0 47 24	34 8 23	5046
Mo. 6	1 1 55	34 3 12	3794
Nhiakuru	0 53 35	34 20 24	4635
Kingamata	0 57 47	34 21 59	4851
Masara	0 58 25	34 17 4	4308
Tingana	0 59 4	34 26 52	5382
Mo. 8	0 58 43	34 8 51	3737
Mo. 2 (Guekeri)	0 59 33	34 5 42	3998
II.	1 2 47	34 9 7	4139
III.	1 3 45	34 9 56	4258
Nun. 20	1 11 15	34 7 10	5028
Bitambi (Nun 17)	1 11 33	34 10 49	4930
2 Rocks	1 11 5	34 13 10	4812
Gurribe Tree	1 7 37	34 16 29	5070
K.T. 3	1 8 30	34 19 26	4866
Niasoku	1 4 46	34 20 31	4885
Mkurue	1 2 7	34 22 32	4786
Buku (K.T. 4)	1 12 4	34 23 24	5123
K.T. 1	1 3 33	34 24 51	4900
Butende	1 11 6	34 26 12	5271
Tarageti	1 13 20	34 30 58	5376
Two Rocks	1 17 20	34 36 29	5860
Chilato	1 14 2	34 38 40	5703
K.J. 4	1 6 23	34 39 47	5669
Mwita A.	1 4 16	34 42 34	6582
Mwita B.	1 5 58	34 45 30	6705
Lolgorien	1 13 13	34 46 10	5791
Longawonne	1 10 42	34 46 29	6084
Erok	1 19 48	34 47 17	6166
1	0 58 38	34 52 41	6892
Lolmaiinget	1 1 42	34 53 47	6754
23	0 56 43	34 54 9	6785
2	1 30 50	34 57 54	5272
4	1 31 23	34 59 7	5249
3	1 24 10	35 1 30	5321
1a	1 18 55	35 1 1	6216

Name.	Latitude S.	Longitude E.	Height in feet.
	° ′ ″	° ′ ″	
26	0 54 27	35 4 47	6847
27	0 49 8	35 5 47	6531
9	1 39 10	35 7 45	6137
15	1 24 7	35 13 16	5514
16	1 16 17	35 23 14	6981
13	1 6 14	35 15 13	7092
25	1 5 10	35 18 41	7083
Longwatat	1 36 12	35 20 10	6783
Leuderut	1 43 2	35 20 49	7174
8	1 34 35	35 23 15	7225
5	1 22 57	35 25 50	6160
Mwusilo	1 41 16	35 26 52	7374
49	1 44 59	35 27 45	7075
43	1 39 59	35 28 32	7282
50	0 54 45	35 28 26	7495
53	1 52 2	35 29 40	7310
18	1 36 24	35 33 49	7357
40 (Rocks)	1 47 10	35 32 56	7205
40 (Top)	1 47 1	35 35 5	7332
55	1 16 27	35 25 55	6574
52	1 53 52	35 33 15	7688
51	1 46 23	35 36 42	7377
39	1 57 11	35 37 34	8348
54	1 44 43	35 40 38	7210
62	1 36 19	35 41 36	8087
63	1 49 22	35 42 21	7553
32	1 32 24	35 43 4	8233
59	1 46 38	35 44 58	7296
56	1 44 39	35 47 39	7751
33	1 39 10	35 49 8	8782
34	1 39 29	35 49 24	8818
60	1 48 32	35 50 15	7554
65	1 53 11	35 51 9	7447
58	1 55 13	35 51 17	7523
66	1 54 18	35 52 22	7554
71	1 40 23	35 52 7	8822
57	1 44 17	35 53 28	8777
72	1 42 40	35 54 21	8154
67	1 58 15	35 55 21	6933
61	1 47 22	35 56 52	7730
80	1 57 46	36 1 10	4553
Shombole Top	2 8 8	36 5 18	5173
Gellaich	2 36 46	36 6 8	9664
Point on Magadi	1 56 3	36 15 15	2057
Lenderut	2 5 42	36 16 58	4072
Suswa (Ol Doinyo Nyuki)	1 10 29	36 20 48	7673
Lorgosailich	1 41 34	36 25 0	5667
Lu. 7	2 19 11	36 26 14	6012
Longonot	0 54 55	36 26 42	9012
85	2 13 23	36 29 18	5062
Meto Tree	2 23 41	36 30 41	6874
70	2 19 22	36 31 53	6925
Lasagut	1 30 9	36 32 35	6855
75	2 8 29	36 34 5	5732
Lamwia (Lamuyu, Ol Doinyo Ol Aisur)	1 25 13	36 38 12	8031
Telethungetung	1 51 35	36 39 38	5888
73	1 44 26	36 40 6	6622
69	2 19 48	36 39 27	6849

Name.	Latitude S.	Longitude E.	Height in feet.
	° ′ ″	° ′ ″	
Longido	2 41 52	36 42 45	8645
74	1 59 32	36 44 3	6974
Lemeboiti (Bisil)	2 8 28	36 45 12	7018
Erok N. Rock	2 26 53	36 45 34	7648
Arusha (Meru)	3 14 32	36 44 49	14,962
East foothill	2 30 47	36 49 45	6180
Lolginegi	2 44 13	36 56 3	3972
Rocks	2 41 14	37 0 0	3898
N. 3	2 41 14	37 9 10	3978
Merrisherri	2 40 52	37 10 45	3984
No. 2	2 43 3	37 11 51	3989
El. 1	2 30 50	37 29 48	4205
El. 2	2 31 47	37 29 13	4439
Olobrauk	2 53 11	37 25 56	4959
Malagogoi (W.)	3 21 33	37 39 45	3577
T.	3 22 59	37 33 54	2935
Reata	3 25 47	37 38 40	3175
U.	3 26 29	37 35 1	2603
Ugweno	3 34 10	37 39 59	6135
Ugweno foothill	3 34 22	37 43 21	2834
Ugweno 2	3 34 29	37 35 44	5779
Mbare	3 44 21	37 38 57	6981
Lonukeri	2 36 41	37 41 24	4202
Sambu	2 36 39	37 43 39	4768

Before the paper, the PRESIDENT: Captain Smith, who in Africa has the local rank of Colonel, is known to our Society mainly by his having read a paper to us of a very excellent character some seven years ago on road-making and surveying in East Africa. Captain Smith is an Engineer officer who went out to East Africa in 1892, and has made repeated visits there, during which he has done a great deal of useful work; but a little over two years ago he was appointed by His Majesty's Government as the head of the British section of the Anglo-German Commission for marking the boundary between the Victoria Nyanza and Kilimanjaro. His expedition lasted for a period of about a year and eight months, and terminated a few months back. Captain Smith has, during the course of that period, not only done good political work, but also some excellent geographical work. I am told that his survey work on that expedition is of a remarkable character. I should mention that we have here to-night one or two distinguished guests from East Africa. We have His Highness the Sultan of Zanzibar, whose ancestors have had a long and historic connection, as you know, with all those regions. And, in the next place, we have present here to-night Hauptmann Schlobach, the leader of the German section of this boundary commission, who has done us the honour of coming from Berlin to-day for the express purpose of being present at this meeting. During that expedition of a year and eight months the most perfect harmony existed between the German and British sections of the expedition. That does great credit to Hauptmann Schlobach and his companions, and also to Captain Smith and his companions; and it is one more proof that Englishmen and Germans, when not incited by over-zealous newspapers, can work together just as harmoniously as they did in the days of Frederick the Great. I will now call upon Captain Smith to read his paper.

After the paper, the PRESIDENT: I am sure you will now wish me to invite Hauptmann Schlobach to address a few words to this meeting.

Hauptmann Schlobach: This my first visit to England is undertaken to accept the very kind invitation of the President and Council of the Royal Geographical Society. I need not assure you that I feel greatly honoured by this kindness, and by the fact of my being here you can see that I was always able to work harmoniously with my British colleagues in Africa, not only with regard to the boundary work, but all through our private relations were very friendly. The work we have done has doubtless some scientific value, and I would direct your thoughts to the fact that our work had not only a local interest, but possessed a wider character, as we succeeded in joining the 30th meridian with Zanzibar, which has been accurately fixed with Cape Town by the exchange of electric signals. I hope very soon to see my British colleagues in Berlin. And now I have to thank you once more for the kind hospitality you have shown me this evening, and I would say how much pleasure and honour it has given me to be amongst the members of this the most distinguished Geographical Society of the world.

The President: I now propose calling upon Sir Clement Hill, a Member of Parliament, as well as of our Council, not because he is a member, but because he has not only visited these regions, but, for many years at the Foreign Office, was a sort of autocrat who directed their destinies. I hope he will kindly say a few words.

Sir Clement Hill: It gives me peculiar pleasure to stand here to-night, partly owing to my near acquaintance—official, and, I hope I may say, friendly—with the Sultanate of Zanzibar, whose Sultan we are proud to welcome amongst us to-night, and partly because I had the privilege of accompanying Sir Bartle Frere, one of your Presidents, to Zanzibar in 1873, where we received, even in times of great stress, when relations were not so easy in those countries as they now are, a most cordial and friendly welcome from the Sultan. I am proud to think that these relations have been encouraged and improved since, till we welcome amongst us the Sultan of the present day. He was educated at Harrow, talks English, understands the character of the English nation, and, I am quite certain, will do his best to give that support to the geographers, explorers, and commercial men of this empire which his ancestors have always accorded to us before. I remember when we went to Zanzibar, the great traveller Livingstone had recently been rediscovered by Stanley. We went out with an expedition fostered and promoted by this Society to give relief to Livingstone. That was the expedition of Cameron. It shows the great difference of the conditions of those times when Cameron's expedition, which started from Bagamoyo, had the greatest difficulty, not only in making a start, but in making any progress at all. Out of the four Europeans who started, Cameron himself was the only one who survived to cross the country, and he came out in Portuguese territory two years afterwards. That was one of the great journeys made by a representative of this Society. Now we have the great difference that our representatives will come back after journeys which, in their way, are at least as important and almost as difficult as Cameron's, and they receive hardly any notice in the Press. They report to us how they communicate with one another, they fix their different positions by telegraph, they get to their destination by train, they have their caravans with the very easiest methods of transport, and, instead of all the difficulties and all the deaths which occurred before, they come back amongst us well and strong to say that the country is a habitable country and that it has a still greater future than that which has already been brought to it by the efforts of geographers. The work of the Foreign Office has always been to encourage cordial relations with our friends of other countries

who march with us, and all the time I was in the Foreign Office, I believe I can honestly say that there never were any difficulties with our German friends on the frontiers. They have since shown how cordially they can work with us by the work which we have seen shown on the screen and by the description which has been given us, and I am quite certain that those relations in Africa will always continue. Captain Smith has not told you what he must be very proud of, namely, that the Smith whom he alluded to as having made these excellent surveys was his brother. He was the person who brought the survey from the coast to Kilimanjaro, and it has been given to the two brothers of that family to complete the whole of that boundary between Germany and the British sphere. I can only add, I am profoundly impressed by the advance which has been made in our knowledge of East Africa, by the facilities which are given, and by the extraordinary friendliness of the natives whom we meet there, and the great ease with which travelling is now done throughout the eastern coast of Africa. I think, before I sit down, that I should like—I am not quite certain whether it is in my province properly to do so—but I can hardly refuse myself the pleasure of calling your attention to the fact that we have amongst us the representative of a newly born kingdom. We have here amongst us a man whom many of you have listened to, when you heard in the Albert Hall, as I did, that extraordinary history of his wonderful journey towards the north pole—I mean Dr. Nansen. I am sure we shall all cordially welcome him, and, although he cannot tell us about tropical Africa, we can feel in his presence, that whilst we are warmly inclined to him, he will not have a cooling influence amongst us.

The President: I will now call upon Major Bright, whom you may remember is the recipient of one of our awards this year. He accompanied Captain Smith in his expedition, and he has done excellent work in other parts of Africa.

Major Bright: The comprehensive paper which Captain Smith has read this evening does not leave much need for additional information. A fact, perhaps, worthy of notice is, that during the commission's journey no trouble was experienced with natives through whose country it passed. For about three and a half years British and German officers were working together delimitating the boundaries between their respective protectorates. That they were not only on speaking terms, but on the best possible terms, with each other, after spending such a long time together in such tropical and trying climates, speaks well of the tact and good feeling displayed on both sides. Hauptmann Schlobach, in conjunction with whom the British were working, is present this evening, and I can only express the sincere pleasure his arrival in England has given to those who were so long his colleagues in East Africa and Uganda. Captain Smith, not content in having already surveyed a considerable portion of East Africa—he has been out there on three separate expeditions surveying—is shortly to return as Surveyor-General, and I can only tell him that he carries with him the best wishes of all the officers, myself included, who had the pleasure of serving on his last expedition.

The President: I will now call upon Major Close, who, as you know, in the Intelligence Department of the War Office, takes charge of what I may call the military geographical information of all the British Empire, with the exception of India. He is the highest living authority on the geography of the British Empire from that particular standpoint.

Major Close: Our explorers and surveyors, like Captain Smith, do their best to make Africa uninteresting. We have every year a great succession of elaborate surveys—and how elaborate, I suppose, only those know who are, so to speak, in the technical world—which are gradually reducing Africa to a place as well known as the United Kingdom. There is hardly a town in Africa that we do not know

the position of, within about 10 miles—in fact, most towns we know within 2 or 3 miles.

Major VILLIERS: I am sure it is quite an unexpected honour to me that I should be asked to address this meeting. It is a great many years since I was in East Africa, but the photographs which we have seen depicted on this sheet have brought home very vividly to me the long marches I had many years ago with the late Sir Gerald Portal. It was owing entirely to the late Sir Gerald Portal that this country was taken over, and I feel certain that in the near future we shall find that East Africa will form one of the brightest gems in the British Empire. It is capable of growing almost anything, it has every class of soil and every class of climate. In finding one's self on an expedition such as I was on many years ago, one looked forward to what the future might bring forth for this country, and I must say that I think the Foreign Office can congratulate itself upon the enormous developments which have taken place. When I walked to Uganda it took us seventy-five days to walk there from Mombasa, but now we find a railway which will take you there, I believe, in about two days, and halfway up the railway, I hear, there is a large town sprung up at Nairobi, which in those days was open veldt inhabited by game. I think no one could walk through a country like that without having great interest in the country, and I have, I am glad to say, been able to try, in a small way, to help the development of that country. For the last two or three years we have been trying to start Australian sheep there, and there is no doubt that on the high plateau in East Africa the Australian sheep will live and thrive very well. Also in that country, at an elevation of, say, 6000 feet, the white man will be able to live and farm and earn a good living. I think one of the drawbacks to East Africa is, that up to the present time it has not been properly developed, and people do not know enough about it. There is, between Uganda and the coast, a country of many thousands of square miles, where white men can undoubtedly live and live well. Again, in East Africa no doubt a large part of the country is fit for the overflow population of India. Up to the present time, I believe that no minerals have been found in the country; but if minerals are found there, the Government will find that they have the same difficulty to contend with in East Africa as they had in South Africa, namely, the labour question. I think, before I sit down, I cannot do better than draw attention to the fact that this fine country is the natural place for the overflow population of India, and more attention ought to be drawn to that fact than has been hitherto.

The PRESIDENT: I now rise to propose a hearty vote of thanks to Captain and Colonel Smith for his very interesting address. Some remark was made about geographical details; you will find full details of the geography of his expedition in the *Journal* of the Society. We have had an interesting discussion, and I only propose to say a few words on one remark which the last speaker made. He said it was Sir Gerald Portal who took over those countries; it is perfectly true Sir Gerald Portal took them over for the Crown, but I hope it will never be forgotten that those countries were acquired by the Imperial British East Africa Company, and if it had not been for the efforts of Sir William Mackinnon and his associates—I am sorry not to see Sir George Mackenzie here to-night—there would have been no British East Africa to take over.

NINE YEARS' SURVEY AND EXPLORATION IN NORTHERN AND CENTRAL CHINA.*

By Lieut.-Colonel A. W. S. WINGATE.

The many accounts which I have read of the Great Wall (especially one in a book published by John Murray this year) are inclined, in my opinion, to convey a totally false conception of this Brobdingnagian undertaking. I have seen it in over twenty different places widely apart, and have heard many verbal descriptions of it in other places from travellers, and I have arrived at the conclusion that it was built by degrees and in sections in the first instance, not of hewn stone, but of round boulders and earth, and that the different sections were repaired from time to time as they fell into ruin. Only in the valley bottoms and on the passes was it composed of masonry or brickwork. The Mings rebuilt of solid masonry all those sections through which led a likely road for invading Tartars to follow, or where it could be seen from a distance against the sky-line; of these the chief, and the only one really worth a journey to see, is at Ch'a-tao, the northern entrance to the Nan-k'ou pass. The First Emperor's conception may have been a great one; but with a population like the Chinese, and a system of government like that in existence in China before Christ, the building was a sufficiently simple affair, and not to be compared, as it has been, with the Great Pyramid of Egypt.

But to continue. Our road crossed several passes, notably Tsŭ-ching-kuan (1800 feet), 15 miles west of the Hsi Ling, the scene of conflict in 1900 between Chinese troops and Boxers on the one side, and German, Italian, and Indian troops on the other. That this should have been so was quite in accordance with the dictum that history repeats itself; for it was by the road leading over this pass (and the one we followed) that successive hordes of Mongols and other invading armies have descended on to the fertile plains of Chih-li. Though once a cart road throughout, it is now only passable for animal-pack transport where it leads over the pass. The construction of the railway, now well advanced, from the Pei-han line at Cheng-ting Fu to T'ai-yuan Fu, the capital of Shan-hsi, will hasten the abandonment of this difficult road as a trade route.

It is impossible, in the limited space at my disposal, to describe in detail all we saw of geographical interest on our way to Wu-t'ai Shan. A few general remarks must therefore suffice.

The main geological characteristic is limestone covered by loess forming a succession of fantastically shaped mountains almost bare of

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* Read at the Royal Geographical Society, December 17, 1907. Maps, p. 368. Continued from p. 200.

trees or vegetation of any kind, interspersed with narrow, but extremely fertile valleys, watered by streams of varying dimensions, but similar in general characteristics. The roads or paths mainly follow these river-beds, which are more often than not a mass of stones; so progress is slow and very laborious. In the loess the going is excellent when dry, and, owing to its adhesive and slippery character, it is easier riding or driving than on foot.

On August 28 we crossed the divide between Chih-li and Shan-hsi provinces at P'ing-hsing-kuan, 4500 feet. Heights are only approximate. Careful observations with B.P. thermometers and aneroids were taken throughout the journey; but the results, as worked out by Captain Turner, are not available for inclusion in this paper, but will, I hope, appear in the published maps.

From this elevation we obtained our first view of the northern peak of the Wu-t'ai Shan, 35 miles distant. On this pass only a few towers remain to mark the alignment of what was once an inner branch of the Great Wall. The people along the route speak with a different accent to that of the inhabitants of the Great Plain; they are more timid, less intelligent, ruder, and have not the habit, as is the custom further east, of passing one the "time o' day." There are numerous orchards, chiefly apple, apricot, the jujube plum, and walnut.

On August 29 we experienced a very heavy hailstorm; the size of the stones varied from that of a pea to a pigeon's egg. It only lasted fifteen minutes, but caused such a heavy spate in the river-bed as nearly to drown a surveyor. Such hailstorms are of frequent occurrence in the hills of North China. Lieut. Doveton told me of one he experienced in the hills 30 miles north of Peking, when the stones were as large as hens' eggs. This seems almost incredible, unless he meant eggs laid by Indian hens!

Our ponies, who had been having rather poor food, now got oats—a crop much grown in the mountain districts of Shan-hsi. Potatoes were plentiful—the same variety as our own. In respect to the potato, Sir Clements Markham stated that it was "through Warren Hastings' forethought and care in considering the nature of the country in Tibet and to the eastward, that the potato was introduced about 120 years ago. And it has undoubtedly spread from the valley of Lhasa into Ssŭ-ch'uan." Now the potato is grown all over the hilly country of North, and in many parts of Central, China, especially in Shan-hsi and the K'ou-wai. It is mentioned by many travellers, and is now a staple food of these people. Shan-hsi is one of the earliest civilized parts of China long before Warren Hastings' day.

Are we, then, to believe that the Chinese only began to cultivate the potato a little over a hundred years ago? It is quite possible, for it is stated that opium has not been grown much longer. These examples are of interest, as, if correct, they tend to show how quickly new

plants and habits can be introduced and spread over this vast empire. Excellent grapes are grown, from which a palatable wine is made.

On August 30, we climbed the Hua-yeh-ling (pass, 7500 feet), and reaching the top, the holy place of pilgrimage, with its red and white, golden and yellow-roofed temples lay, silent and beautiful, in a narrow well-wooded valley, at our feet. On the pass we met several Mongols with their ponies hurrying back to their native soil, their pilgrimage completed. One Mongol was prostrating himself full length on the ground nine times, making his last Ke-t'ou to the P'u-sa-t'ing, the principal temple of this Mongol Mecca. That night we took up our abode in one of the temples, at an elevation of 6000 feet above sea-level, in comfortable quarters surrounded by the Wu-t'ai, or Five Peaks. Though it may appear remarkable to those acquainted with the usual condition of things in lama temples, our rooms were clean and free from uninvited guests.

Wu-t'ai is an ideal spot in which to pass the hot, enervating months of July and August. Here the temperature stood at 60° in the shade at noon on a bright sunshiny day, while a few miles down the valley 70° could be got; and to those who prefer the cold, a climb to the top of any of the five surrounding peaks will give as low as 45° to 48° Fahr. in the shade, even at that season of the year (August). We made a plan on a scale of 6 inches = 1 mile of this the most famous Buddhist, or rather, ought we to say, lama, place of pilgrimage (there are several others of the same name in China, notably in North Ho-nan and in North-East Hu-pei, to which Manifold has referred, but these are mainly for orthodox Buddhists), the execution of which caused some consternation among the priests, who, having only recently heard of the arrival of our mission at Lhasa, wondered whether we might not be the advanced guard of a similar expedition to their retreat.

On September 1 we were awakened at 3 a.m. by a deafening noise of drums, gongs, and horns calling the priests to early prayer. Once started, prayers continue on and off till noon. Then a meal (they had previously partaken of a light meal of small millet soup about 8 a.m.) and sleep till 4 p.m., after which prayers again commence and continue till dark, when the evening meal is eaten.

Prayers consist mainly in chanting the Buddhist liturgy, turning prayer-wheels of many shapes and sizes, and walking at a fast pace round and round the central building, always in the direction of the hands of a clock—this, I suppose, by way of a constitutional!

About 8.15 a.m., on September 1, we started to ascend the Chung-t'ai, or central terrace, which lies next to the Pei-t'ai, or northern one, on the west side. We reached the top at noon, after a pretty steep climb over grass-covered bare slopes. The summit is a water-logged plateau or terrace of about 400 to 600 yards in diameter. This is covered with the ruins of what must once have been a very fine temple, built of solid

blocks of granite and limestone. Carved dragons and lions and obelisks lie strewn about. The bulk of the remains have been collected into a single structure 40 × 15 × 10 feet. Inside this are three vaulted chambers with cast-iron images of Buddha. Two slate tablets let into the wall on the west of the entrance give a history of the temple and the names of those who, by subscribing to do this work, hoped to earn merit.

In front of this rough structure, on the south side and in the middle of what was once evidently the central courtyard of the temple, is a pagoda, 30 feet high, of carved stone. Further south, about 100 yards distant, are the remains of a masonry terrace and pagoda. From this spot a magnificent panoramic view is obtained of the other four "t'ai," and the valleys beyond; and here, no doubt, the emperors and other distinguished pilgrims have sat when visiting—as they have done for over a thousand years—this mountain summit.

According to Rockhill, these temples on the summit of Chung-t'ai were built in A.D. 581–601. The three travellers who have left records of the height of the Pei-t'ai, or north terrace, all give approximately 10,000 feet. We made the Chung-t'ai 9600 feet, and computed that the Pei-t'ai was 400 feet to 500 feet higher. With a temperature of 48° in the shade, water boiled at 195·6°. We could see no other peak higher than the Pei-t'ai. As already mentioned, the highest peak of the Hsiao-wu-t'ai Shan is certainly under 10,000 feet, and I am inclined to believe that the Hing-an mountain range, of which the Greater and Lesser Wu-t'ai might be called southern extremities, does not contain a single peak over 10,100 feet above sea-level; moreover, in all probability, no peak of the Hing-an, lying north of the Lesser Wu-t'ai, reaches 7000 feet. The next highest mountain in Shan-hsi to the Greater Wu-t'ai, is a curiously shaped one with three peaks lying south-east by east of the Chung-t'ai, and about 30 miles distant. We were unable to discern the mountain mentioned by Edkins, as lying to the north-east, and which he says is higher than Wu-t'ai.

The rocks are mainly granite and sandstone, with an admixture of quartz and conglomerate. Excellent coal comes from Ching-ho-wa, 35 miles to south-east.

Oats are grown within 1500 feet of the top, *i.e.* at an elevation of 8000 feet, and rhubarb at 7000 feet. The whole hillside is cultivated, giving a kind of chess-board appearance. There is less terracing than in other parts of China. A remarkable thing (considering the limited area of these plateaux) is the large amount of water at 9500 feet, and that in spite of an extremely dry year. At 8000 feet there were springs of water. Scarcity of water along the routes had resulted in a large falling off in the number of Mongol pilgrims, consequently, as the Head Lama carefully explained to us, there was a heavy shortage in the amount of contributions. Pilgrims give both in cash (anything from

10s. to £100) and in presents of appurtenances for the temples. The chief industry of the place is the making of copper and bronze idols. It may be interesting to mention that the Dalai Lama was then in Urga, and the priests said that he would never return to Lhasa as another had been appointed in his stead. Evidence of the decay of the lama religion is the absence of any Mongols approaching the shrine by prostrating themselves at full length on the ground, as mentioned by Edkins years ago. Even the few who do prostrate themselves for a number of hours daily, do so with extraneous assistance in the shape of smooth sloping boards, and pads for the hands, knees and forehead.

A TYPICAL ROAD IN THE MOUNTAINS OF NORTHERN CHINA.

It is small merit such pilgrims will store up for themselves, though the exercise is no doubt conducive to a good appetite and digestion.

Rockhill speaks of 360 temples in the valley. In 1905, omitting very small insignificant places, there were only 107. Of this number 30 are at Wu-t'ai itself (of these only five are called "Ta," or Great); the remainder are scattered along the valleys through which the main route from Pao-ting Fu leads. There is a fine pagoda in a prominent situation; at the time of our visit it was undergoing repairs, the expenses being met by a local merchant desirous of piling up merit. It is 70 feet high. Two splendid stone lions are all that remain intact of the Emperor Kang-hsi's picturesque summer residence, now a mass of ruins overgrown with foliage and grass. As at Je-ho, so at Wu-t'ai, the decay of lamaism is everywhere in evidence. A Japanese called on the chief lama during the time of our visit.

On September 5 we said good-bye to our kind Mongol friends, and made our way to Wu-t'ai Hsien (the chief town of the district);

thence we proceeded by unsurveyed routes to the Pei-han railway at Cheng-ting.

The country was wild and rugged. The main points worthy of remark are, the perseverance with which the Chinese carried coal for distances up to 50 miles from the mines over the most heart-breaking tracks imaginable; the steepness (30°) of the descent from the Hei-shan-kuan (4800-feet pass); the broken character of the hills, which were nearly bare of trees; the labour and skill with which the people cultivated the steep mountain-sides to a height of 8000 feet above sea-level, the fertility of the loess, and the almost total absence of game and small birds.

The Central China Region.

In 1903 and 1904, Lieut.-Colonel Manifold had charge of the expeditions devoted to gathering information concerning the geographical and commercial aspects of the western half of the great Central China region. Lieut.-Colonel Manifold gave an account of his explorations in two interesting papers read before this Society, mainly devoted to the province of Ssu-ch'uan, which is held to be, no doubt with reason, one of the finest fields for future commercial enterprise. Distance, ever prone to lend enchantment to the geographical horizon, has always had its attraction for explorers. Thus it happens that the remoter regions of the Chinese Empire have received rather more than their fair share of attention. In our efforts to learn as much as possible about these distant lands, thousands of miles from the sea-coast, we have somewhat overlooked those not less geographically interesting and commercially profitable, though little-known, districts within easy reach of ocean-going steamers.

Looking through the *Journals* of the Royal Geographical Society for the last fourteen years (1893 to 1906), out of twenty-five papers devoted to the Chinese Empire (excluding Chinese Turkestan and Tibet), there appear to be only three dealing with Northern China, and none at all relating to the eastern portion of the Central China region. In the number of the *Journal* for November, 1898, is a useful compilation by Mr. G. Chisholm dealing with China as a whole, but it requires bringing up to date.

This is an astonishing fact when we remember the importance of these regions, and, until quite recently, the lack of accurate geographical information concerning them, so that even now there are quite large areas which are scarcely explored.

I cannot do more here than mention the extensive explorations done in 1903–04 by Lieut. Webster in North Ho-nan; along the Yellow river; in the hills in the triangle Ho-nan Fu, Lung-chü-hai, Nan-yang Fu; in south-east Ho-nan, and north Ngan-hui. He surveyed in some six to seven months between 2000 and 3000 miles, with the assistance of

two surveyors who generally followed different routes to Webster's. The Peking Syndicate's surveys, executed by Survey of India men, formed the basis of the sheet of Ho-nan province, and Webster's work was mainly responsible for the rest. The hills in the triangle above mentioned had never been explored by a foreigner before. Those north of the Lo-Ho (that historical ground of ancient China) were explored by Manifold and Hunter in 1901–02.

If it is in a country with a growing population that we must look for the increase of trade, then may we safely turn our commercial attention to the eastern section of Central China in general, and to Ngan-hui in particular. Devastated during the Tai-p'ing rebellion, it is recovering rapidly, and its population is increasing by leaps and bounds.

The 'Encyclopedia Britannica' translates its characters, "Peace and Plenty" (a doubtful meaning), and justly calls it "one of the most productive provinces of China." Richthofen says of it, "The exuberant fertility of the soil in the lower portions of the province" (and I would add in the central also—A. W.) "is not excelled by anything I have seen in temperate climates. No expense has therefore been spared in protecting the lowlands by embankments, and introducing a perfect" (I would rather say nearly perfect—A. W.) "system of irrigation. Both deserve the highest admiration."

It was the difficulty of learning anything about Ngan-hui province (except along the banks of its main artery, the Yang-tzu Chiang and the country contiguous to it) that first guided my steps in that direction.

As with Outer Chih-li, so with Ngan-hui—with the exception of a page or two in the late Baron von Richthofen's "Letters," and a short paper in the reports of the Chinese Imperial Customs, we have to turn to the French and German languages for information available to the public. As so often happens, the French were before us in this matter, and Père Havret's little work, though somewhat out of date (1890–93), is of great value. It is for this reason, and that they are among our most recent travels in China, that I thought it might be of interest to tell something of a territory not much heard of in this country, although, strictly speaking, only about one-third of it is included in the term "Northern China."

First, a few figures to give some idea of the size and population of Ngan-hui province. Greatest length, 350 miles; greatest breadth, 320 miles; which gives an area of 54,000 square miles—that is, about the size of England, the state of New York, or Uganda. Population, 24,000,000, equal to Austria, or to the Royal Niger Company's territory plus the Niger Protectorate, and only some eight millions less than that of England and Wales. This gives a density of about 440 to the square mile, equal to that of Belgium. The above are the official figures, but I incline to think they may be overestimated, though every year there is a steady increase both by birthrate and immigration.

The name Ngan-hui (the *ng* at the beginning is an attempt to give the peculiar nasal sound to the word) is derived from its two most important cities, Ngan-ching (the capital) and Hui-chou, the chief city south of the Yangtzu-Chiang. The words signify "Peace and Excellence," which might truthfully be rendered "Peaceful Beauty," if applied to the southern half of the province.

The province is split up conveniently and naturally by the rivers Huai and Yang-tzu into three parts, each with its marked characteristics. North of the Huai is level plain, with nothing but a few isolated mounds to break the monotony. It is, in fact, a continuation of the Great Plain, to which it belongs, together with its icy dust-laden blasts, its crowded though poor population, its carts and its mules (camel caravans and cart traffic are, on the northern bank of the Huai, giving place to coolie transport and wheelbarrows south of it), and its scanty flora and fauna. The central portion, lying between the Huai and the Yang-tzu, is half mountain, half plain, studded with lakes and low-lying, inundated tracts. The population is less dense than in the northern region. The part south of the Yang-tzu differs altogether from the other two. It is mountainous, with a comparatively wealthy and fairly dense population.

Though there are as yet no railways, and the roads are poor, intercommunication between these three regions and the neighbouring provinces is easy, owing to the numerous waterways. Thus Nganhui unites in one province the main characteristics of North and Central China, as well as the coastal country of Kiang-su and Chêkiang.

Geologically, the northern region is, as already stated, alluvial soil like the Great Plain, with occasional patches of loess in the valleys between the outlying spurs of the K'un-lün, which are composed of sandstone, granite, and marble. The branches of these spurs extend eastwards as far as the Hung-ch'ih lake. South of the Yang-tzu we have the Nan-shan range, mainly composed of granite, limestone, and schist, with alluvial soil in the valley bottoms, but no loess. I have been in Japan, and was struck by the general similarity in appearance of the scenery of southern Ngan-hui and Japan. Richthofen states that the geological formation of the two countries is similar. If we except the immediate neighbourhood of Wuhu, a favourite centre for cold-weather shooting among the foreigners residing in the lower Yang-tzu basin, very few people, except missionaries, have travelled in the south and most interesting part of the province, except along the borders of the Yang-tzu river. Of those who have, I can only find records in English of Brawn in 1794, Fortune in 1848, Richthofen in 1871, though, of course, there may be others.

Previous to our visit, with the exception of two railway reconnaissance surveys, none of it had been surveyed—at least, there are no

published records of any—and the maps (the best of which were the Chinese and Père Havret's based on it *) were very faulty indeed.

There is little of special interest to tell concerning the country north of the Huai. It is densely populated by poor, though hard-working farmers, who do not find time for much else. The conditions in this part are almost identical with those of the rest of the Great Plain, except that, partly for purposes of protection against robbers, and partly against floods, the villages are raised above the level of the ground, on little islands, so to speak, with often a mud wall and moat.

In the northern part of the central belt, the aspect of the country is very like that of Southern and Eastern Mongolia—long, gradual undulating slopes, looking like immense ocean waves; as each one is

A FREQUENT SIGHT IN CENTRAL NGAN-HUI.

breasted, another appears about the same distance ahead. The soil is poor, and the population not dense.

In the whole of the region north of the Yang-tzu there is an almost complete absence of timber, which must have a very high value for it to pay to carry tree-trunks from the Po-yang Lake to Lü-chou Fu by water, and thence in wheelbarrows to Fêng-yang Fu, in Northern Ngan-hui, a distance of 80 miles.

To see the wheelbarrow men (many of them intelligent farmers and traders out of present employment) heaving, pushing, and staggering along with their heavy and often unwieldy loads is indeed a lesson to those who believe in the theory that only the fittest survive, and who are accustomed to European and American methods of conveying goods. Yet these men are nearly all opium-smokers. No sooner is their day's journey ended, their evening meal of rice and a bowl of tea or soup consumed, than they hie them to the opium dens, and there pass the

* There is another map by A. Pierre, 'Province du Ngan-hoei,' which I have failed to obtain. It is not among the collection of the R.G.S.

night, laughing, talking, smoking, and gambling. They are up again next morning and well on their road by 7 a.m. Who that has seen these men toiling along the atrocious roads, up and down hill (ay, even steps!), or watched boatmen circumventing a rapid, will be certain that all opium-takers are lost creatures? If they are, who would not try and do something to save such splendid specimens of humanity?

The Huai Ho.

One of the most interesting geographical features of North Nganhui is the Huai river. Hitherto it seems to have received but slight attention. No foreign gunboat has ploughed its waters; only one steam-launch had, at the time of our sail on it, visited its ports. Why is this? The reason is simple—because, through neglect, the Grand Canal from Yang-chou Fu to Ch'ing-chiang-p'u, and the passage from there through the Hung-ch'ih lake, have been allowed to silt up. This is a pity, because once through this latter and in the Huai proper, the depth and width and other conditions of the river are such that river steamers drawing 6 feet could proceed to Ch'eng-yang-kuan, while a smaller type of vessel could reach such places as Wu-lung-chi.

Navigation by steam-launches, and specially built river steamers of a smaller type than those which go from Hankow to Ichang, would find no difficulty in reaching Ch'eng-yang-kuan once in the Huai river itself. Even under present conditions the lowest water in the Hung-ch'ih lake is 3 feet, and highest 10 feet. In width the Huai varies from 100 to 500 yards.

It would be worth while to survey the Grand Canal and the Hung-ch'ih lake with this object in view. Best of all would it be to construct a fresh canal, or improve the existing waterway, from the Huai *before* it enters the lake to the Grand canal about 30 miles above Yang-Chou Fu.

The traffic on the Huai is immense. Ch'eng-yang-kuan is a thriving, bustling mart. According to Chinese sayings, fifty waterways meet about here; but be that as it may, it receives one important tributary, the Sha-Ho, which gives access to the inland port of Chou-chia-k'ou, the most important mart in Ho-nan south of the Yellow river.

Lü-chou Fu is an ancient city, whose people pride themselves on their literary attainments. This is the country and home of the Li family, of whom Li Hung-chang is the best remembered. The great statesman's grave is a picturesque but simple affair by the side of a pond, near the banks of the canal leading from the city to the Ch'ao Hu (lake). Near by are the remains of the grave of an even more celebrated (from a Chinese standpoint) statesman, who lived and was buried here about five hundred years ago. I wonder will the great Li's headstones be in a similar condition five hundred years hence? The older grave receives now no care at all.

Lü-chou is undergoing a great revival, and shows signs of becoming a leading city in the new China that is making. It was in the college here that I was introduced to several fine Chinese lads, whom, in the twilight, one might have taken for English public schoolboys, such was their garb and nonchalant demeanour! In this city, and also in Ngan-ching the capital, we were much struck by the rapid strides which education had made along modern lines. Splendid schools and hospitals are already in full operation, and the thirst for up-to-date knowledge is apparent on every hand. There is regular steam-launch communication between Lü-chou and the treaty post of Wuhu, 100 miles distant by the water route. Along this route small river-steamers might ply, provided some improvements were effected in the approaches to the city of Lü-chou from the lake. Between the lake and Wuhu there is a fine broad waterway of sufficient depth. There is a great traffic carried on along this route.

From Lü-chou the waterway leads one into the Ch'ao Hu, a splendid sheet of water. The north and west shores are flat. Picturesque islands are dotted about here and there, and the scenery along the southern shore is pretty, though the hills are too bare. What they might be with proper afforestation can be seen south of the Yangtzu.

In Ngan-hui, north of the Yangtzu, deforestation reigns supreme, but in Southern Ngan-hui afforestation seems to really have taken root. There the trees got a start in the years following the T'ai-ping rebellion, when there were scarcely any people left to cut them and the undergrowth. While on the subject, I should mention that afforestation thrives also in Hu-nan province, whose thrifty population is too sensible to destroy the goose with the golden eggs.

A curious feature of the Ch'ao Hu is the method of fertilization along the lake-shores which I have not seen elsewhere in my travels in China, nor is it mentioned in Père Havret's book, though he speaks of most things. Unfortunately, owing to adverse weather, contrary winds, and tempests and cold, I was unable to do more than note this matter. To illustrate my meaning, I cannot do better than quote what I find in my diary for that day, bearing in mind that we had spent the previous day in beating against the wind, with the result that we gained barely a mile along our course.

"*November* 3, 1905.—During the night it clouded over (min. temp. in boat with doors shut, 40° Fahr.) and came on to blow hard from the north-east, just the direction we want to go—result, we are obliged to stay where we are, a rather undesirable spot a mile east of the Chung-miao promontory, with nothing to do. Some duck too wild to approach. If one wanders more than 100 yards on either side, one's nostrils are assailed by manure-pits, not made from the usual human ordure, but by pouring the water of the lake into sand-holes and allowing it to evaporate. Result, much smell and a green deposit, the colour of verdigris, and

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called 'cha-ts'ao.' The manure itself looks like a dark-green mud. The shores of the lake are red conglomerate formations of red sand and clay, and very hard. Heavily laden cargo-boats can sail, but not the lighter ones. Very few fish in this lake, but the Chinese say the Pai or Po Hu further south is full of them (Note—this lake has never been explored by foreigners). But no one seems to know anything, and the dialect spoken here is perfectly unintelligible. The boatmen, too, are a lazy lot, and cannot be got to respond to inquiries. Extracting information is like drawing blood from a stone. Blew all day hard from the north-east. Very cold. Progress *nil*."

Passing to Southern Ngan-hui, the district all around Wu-hu for many miles is a network of waterways, embankments, and rice-fields. This is one of the best shooting districts in the Yang-tzu valley, though there is plenty of excellent pheasant-shooting almost anywhere in Southern Ngan-hui.

Even small-game shooting in China is sometimes attended with all the exciting scenes more properly belonging to the chase of sterner game. Every one has read of the unfortunate shooting incident which happened last year near Ngan-ching, to the American admiral on the China station. Well, the first we heard of it was at Wu-hu, and so, naturally, we were inclined to be extremely careful when the local Celestials and the pheasants got too much in the same line of fire.

All went well till one day, at Ning-kuo Fu, my companion and I were out together, and both shot at (and missed or hit, I cannot remember) a fine cock pheasant. Immediately after the shots, I saw a Chinese man running towards us from the left front, and not in the line of fire of the bird, followed by two or three others. He showed a little spot of blood on his lower lip, and, opening his mouth, a very dirty and crooked lot of teeth. He declared he had been hit, and half his teeth knocked out. We argued for a bit, the spectators meanwhile increasing in numbers. At last, seeing he had about two to one the best of us in evidence and ten to one in numbers, I put my hand in my pocket and was deliberating how much to start with, when a man behind me intervened, saying to me, "Don't you be a fool. He was never hit by the shot; he hit himself with his hoe-handle when he heard the shots close in front of him." Then, turning to the culprit, he said, "You be off; you know you are only lying!"

This story serves to illustrate two points: one common to all China, viz. the adaptability of the Chinese nature to circumstances when possible gain is in view; and secondly, that in Southern Ngan-hui, owing to the immense immigration of people from every quarter of China to make up the number who were there before the T'ai-p'ings came, there is a diversity of interests, one man's hand being, so to speak, against all; so that, while on one bank of the river you might be stoned, on the other you would very likely find protection.

Talking of the T'ai-p'ings reminds me that the author of a very popular 'Life of Gordon' told me that somebody had told him that Gordon had said that when he fought for the Chinese Government against the T'ai-p'ings he fought on the wrong side. I do not believe Gordon said any such thing; he fought on the only side he could—on that of law and order. Any one who has walked, as I have, for days and weeks in Southern Ngan-hui, through towns, villages, and farms laid waste by the ruthless band of the T'ai-p'ing rebels, will ever rejoice that Gordon lent his wonderful power in assisting to overcome them. His memory is revered to this day: I have received on several occasions unlooked-for

THE GRAVE OF ONE OF CHINA'S GREATEST STATESMEN, LI HUNG-CHANG.

kindness in the interior of China, for no other reason than that I belonged to the same army as Gordon.

It is when we come to Southern Ngan-hui that we enter a country having certain attributes peculiarly its own. It again divides into two parts—the flat rice-growing country around Wu-hu and bordering the Yang-tzu, and the mountainous interior. In the former one meets with the same characteristics as in other similar localities where the people by growing rice eke out a monotonous life in the struggle for existence. But once inland and all is changed. Two things are immediately apparent. Here were once the homes of an artistic and opulent people, and here also the hand of the destroyer has laid waste

the land. The prefecture of Hui-chou was formerly inhabited by a clever industrious people, celebrated throughout China as merchants and bankers.

Père Havret thus admirably sums up their good qualities: "Hardi et entreprenant dans le négoce, le peuple de Hoei-tcheou laisse aux femmes la garde de ses maisons, il afferme à des étrangers la culture de ses vallées, puis il s'en va au loin chercher une future que la terre lui refuserait. Cette remarquable aptitude des habitants du Hoei-tcheou est consacrée par ce proverbe que toute la Chine connait 'Wu Hoei pu-ch'eng-shih'"—that is to say, "Business cannot be carried on without the people of Hui-chou."

The truth of the above saying is at once seen in the better dwelling-houses, the splendid ancestral halls and memorial arches, with their beautiful architectural designs and sculpture; the number and quality of the bridges; the excellent condition of the roads (a rare thing in China); and the better clothes of the people. Of course only a small proportion of the inhabitants of pre-Tai-p'ing days remain, and one notices quickly the difference between them and the more recent immigrants from Hu-pei, Kiang-si, and neighbouring provinces.

This prefecture is full of interest to the artist, the botanist, and the lover of natural history.

Southern Ngan-hui is fast being repeopled. The inhabitants are very enlightened as Chinese in the interior go, and are anxious for all modern and Western improvements. Even in religious matters they have shown much spirit—some villages having, of their own free will, destroyed their idols. A couple of years ago the students attending the examinations for degrees, attributing their backwardness and ignorance to the bad influence of their idols, destroyed the statues of the eighteen lohan or saints which line the right bank of the river opposite the Hui-chou city. They knocked all the heads off except one.

We found existing maps of Southern Ngan-hui very inaccurate. Altogether in South Ho-nan and Ngan-hui we surveyed 3600 miles of routes and made thirty-one plans of cities and towns in ninety-seven days, including halts.

The mountains of southern Ngan-hui have been very little explored. The higher peaks average over 6000 feet, are forest-clad and exceedingly beautiful. There are many birds, and excellent pheasant-shooting almost everywhere.

Chinese Ink.—One of the chief industries of Hui-chou prefecture is the manufacture of Chinese or, as we wrongly call it, Indian ink. The centre of production is Hsiu-ning, a district town 25 miles west of Hui-chou city. Here is made the supply of ink for the whole empire, indeed for the whole world, if ink of the first quality be required. The firm of Hu K'ai-Wên is world-renowned, and no ink is considered good without this name being on it.

Chinese ink is of varying quality, ranging from eightpence to seven or eight sovereigns a pound, containing from thirty to thirty-two small sticks. I cannot describe here all the finesse of its manufacture, but much depends upon the quality of oil and lampblack.

We watched the men at work in dark, confined rooms at the back of the small shops—much like similar factories in London two hundred years ago—and came to the conclusion that here lay a mine of wealth to the first who should lay down suitable machinery to carry on this industry on modern lines. From 20 to 160 sheets of goldleaf are used per pound, and great artistic taste is exhibited in the various designs. Models of the lohan, or saints, and of temples and mountain scenery are made. Presentation cases for export are now obtainable in Shanghai. Each case contains two boxes, each of which has two beautifully lacquered inner cases. A box contains eight slabs of ink—making a total of sixty-four slabs for $64 or $65 (say, £6 10*s.*), well worth the money, as the ink does not perish by keeping.

Sha-shih to Wan Hsien.

After completing our explorations in Ngan-hui and Hu-pei provinces, we wished to prove by actual examination the possibilities of the route through northern Hu-nan to Wan Hsien on the Yang-tzu (above the gorges) for a railway.

We examined the only available maps, and from previous experience in similar country, made our calculations as to the number of days the journey would occupy from Sha-shih *viâ* Li Chou and Tzu-li to Wan Hsien. We made it—allowing a liberal margin—400 miles, which at 20 miles a day made twenty days.

The distance we travelled (and we went by the shortest route) was 612 miles (all of which we surveyed), and the number of days thirty-three, exclusive of two days in halts, that is at the rate of 18½ miles a day. So much for existing maps of the mountainous districts of the Central China region. Our route lay up the river from Tzu-li to Shih-nan *viâ* Ho-feng, and on to Wan Hsien; almost a bee-line on the map, but it proved one of the most tortuous, roundabout pathways possible to imagine.

We formed the opinion that the particular route was very unlikely ever to be selected for a railway, and that the "chord" line will never be made in our time. The only possible route would be *viâ* the following towns: Tzu-li, Yung-ting, and Lai-fêng to Shih-nan.

So we arrive at this conclusion, that if there is to be a railway to connect the upper and lower navigable Yangtzu sections, it must be more or less, as Lieut.-Colonel Manifold has pointed out in his admirable paper, along the north bank.

There is no published account of explorations in the mountains between the Yuan and Ch'ing-Chiang rivers east of 109° E. long., and

so far as we could ascertain no foreigner (not even a missionary) had ever travelled by the routes we followed from Tzu-li to Shih-nan Fu, and from there to Wan Hsien.

Our work dovetails into my first journey through Hu-nan in pre-Boxer days, and Manifold's and Hunter's work south of the Yangtzu.

The country is wild, rugged, and beautiful. Between Tzu-li and Shih-nan the population is, on the whole, sparse; though there are several small densely peopled and cultivated valleys. Cultivation, as in Ssŭ-ch'uan and other parts of the hill country of China, is carried nearly to the tops of the mountains.

Underground rivers are frequent. In one place I came upon a dirty yellow stream of water flowing from the cave-like recesses of a dark ravine. Ascending this for 300 feet, I found a broad alluvial valley covered with grass, and with several boats lying high and dry on the mud. The only sign of water was a fast-flowing stream (also muddy, but clearer than below) which disappeared suddenly into a hole in the ground, near the head of the ravine up which I had come. Near by was a roadside shrine. The Chinese state that every rainy season these elevated valleys (they average 1500 feet above sea-level) become lakes, the water being often 30 to 50 feet deep, and the only means of communication is by boats. Numbers of cattle and water-buffalo were grazing. The temperature was low, only 48° at midday on a fine but hazy day, March 6. Elsewhere I saw a number of Chinese men and boys engaged in extracting, with small hand-nets, the fish from a pool, which was evidently the last remaining water of one of these lakes.

Our road lay for the most part through deep, narrow gorges with perpendicular cliffs often 2000 feet above the river bed. The undergrowth was very thick and varied in character. Birds were numerous. A section of the route would show many steep ascents and descents of over 3000 feet, sometimes two in one day. The highest passes were about 6000 feet above the level, and the loftiest peaks 7000 to 8000 feet.

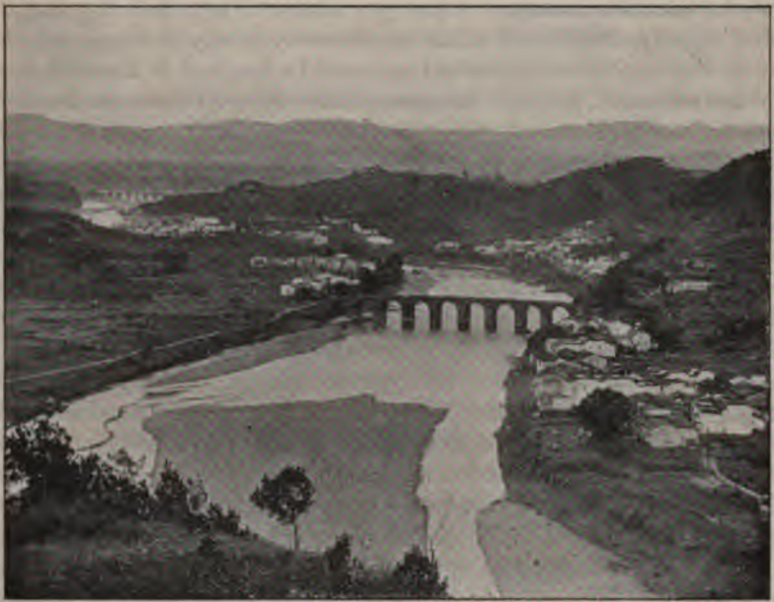
At T'ien-ch'iao, 6 miles south-west of Shih-nan Fu, is a natural bridge under which the river passes. This phenomenon is said to have been due to an earthquake in the reign of Tao-Kuang (1821–1851). Good coal is mined close by; the whole valley hereabouts is limestone and coal; the scenery beautiful.

The Geography of Railways.

Northern China.

This subject has, during my sojourn in the Far East, received more attention than any other. It is worn pretty well threadbare; but I would ask forbearance while I say a few words mainly on behalf of the Chinese. They do not get a fair chance. The bulk of them want railways, want

mines, want every kind of modern and Western invention and improvement. But they must be allowed breathing time. In 1895, and again in 1900, they were hit below the belt, and, like an untrained boxer, they have scarcely had time to regain their equilibrium. Who that has seen them travelling by train in those luxurious (?) third-class carriages will deny that they must have a perfect passion for travelling? See their poor women pushing and shoving to get seats in the train—for all the world like people rushing for front seats at a popular play. Surely such things speak for themselves. Gold, silver, copper, tin, coal, *et hoc genus omne*, lie buried beneath the surface of their splendid inheritance, and they are as keen to get possession of them at the lowest possible



THE BEAUTIFUL VALLEY OF HUI-CHOU PREFECTURE, SOUTHERN NGAN-HUI.

capital outlay as were ever the most astute of South African companies. But as yet they don't quite understand the business. Why should they? They have no London or New York Stock Exchanges to teach them. During the Russo-Japanese war they got no respite; but they learned something, and now they are just beginning to awake as from a foolish dream. Like most revolutions, the Boxer one of 1900 produced the man for the occasion, in the person of Yuan Shih-k'ai, a strong man, knowing his own people's peculiarities well, but not fully versed in the vagaries of the foreign capitalist and concessionnaire. So he said, "I will manage my own people myself, but I will collect around me as advisers men who have been trained and taught by the countries which possess the

greatest reputation for go-ahead methods; and while my poor people are learning something of western knowledge, I will get these clever men to help me to stave off the rush of the foreigner with his uncontrollable fierceness."

The chief of these men is Tong Shao-yi. Now, no one who has met this clever, enlightened, polished Chinese gentleman will be so foolish as to suppose that H. E. Tong believes a railway can be built from Hankow to Ch'eng-tu or Canton without the assistance of foreign capital and brains. Unlike their predecessors, Li Hung-chang and Jung Lu, Yuan, Tong and their friends really know and understand something of Western civilization, and they realize that if these immense railway and mining enterprises are to be undertaken, it can only be with the assistance of foreign nations. They also know that the working of railways and mines in China by purely foreign-controlled companies engenders—as indeed it would in England or America, were our railways and mines to be managed solely by Chinese—so much ill feeling, and calls for so much meddling by foreign governments in Chinese internal affairs, that the people are—and in my opinion quite justifiably — anxious to control them themselves. But this does not mean that, provided they can get it on their own terms, they are adverse to use foreign capital or foreign engineering skill and material in the fulness of time. China is moving, but the Chinese do hate, above everything else in the world, being hustled. They lead the strenuous simple life, but they like to do it quietly and slowly as suits an Asiatic people who, after all, are only what their climate and surroundings have made them. We must grasp these facts, not as we hitherto have done, only in connection with the building of fleets and the making of armies, but with respect to education and economic and industrial enterprise. They want—and who in justice will deny their right to it?—the lion's share of the industrial development of their own country. They mean to learn all about Western civilization, but to apply it in their own time and way for their own people. To tell where and how railways should be made is the business of the engineer and the capitalist. I will only say, therefore, that the Chinese people, as soon as they understand what railways mean, want them and appreciate them. During our recent wanderings we were often welcomed by the people, and by some officials too, as "T'ieh-lu Kuan" (railway officials). We had conversations with many Chinese in the interior, and found them anxious for the extension of the railway, the telegraph, and the post office to their towns and villages. In my opinion the Chinese engineer who, without foreign assistance, will build a line of rail in the best and most economical way from Hankow to Ch'eng-tu, or through the Nan-k'ou pass, or Hün Ho valley to Kalgan, is not yet born. That such lines are desirable no one who has watched the transit of passengers and merchandize through the Yang-tzu gorges, or over Chinese

mountain roads, can doubt; and that they will be costly we may be sure. But whether these, or any other lines, be built with foreign capital or with Chinese, or by both combined (as is most probable), the Chinese can never accuse the British of a dog-in-the-manger policy. It is our explorers and our surveyors who have pioneered the exploration of possible routes by land and water—made maps of their mining districts, plans of their mineral deposits and cities, charts of their coasts and rivers—in a word, discovered for them their natural assets, and though for a time some of the results may be regarded as confidential, sooner or later they become available for the Chinese, when ready to make use of them, and it is they—and rightly so—who will benefit.

There are those perhaps who may regard expenditure incurred in doing for the Chinese what they should do for themselves as money and labour wasted. I find myself unable to subscribe to such a creed. A little open-handed liberality is appreciated by any one, but more particularly so by the Chinese, among whose virtues hospitality and liberality should most certainly be included. I have never found them niggardly. True, they will spend hours bargaining over a single cash ($\frac{1}{35}$ of a penny), but once the bargain is struck they stick to it and do not grudge a few extra cash over a side issue. They have something of the Americans in their disposition. If they get money easily and quickly they spend it in the same way.

Railway construction has been more successful and rapid in Northern China than elsewhere in the Empire, and we can now proceed by rail from London to Hankow (600 miles inland from Shanghai), a distance of 7500 miles, except for the crossing of the English channel. The branch to Kalgan has reached the mouth of the Nan-k'ou pass, where I am afraid it is likely to remain for a rather long time. This section was built by Chinese engineers, but it will take a very clever engineer to make a good job of the ascent of the pass—a rise of 1400 feet in 12 to 13 miles in a very confined gorge, so that the gradient is not likely to be less than 1 in 65, even allowing for 18 to 20 miles of line. We have surveyed the gorges of the Hün Ho where it flows from the Hsüan-hua plateau on to the Chih-li plain, and it is an open question whether a railway to Kalgan might not more profitably go by this route, which is considerably shorter. No doubt the initial expenditure would be much greater, but once made, the working cost would be a good deal less, as the sudden ascent of the Nan-k'ou pass would be avoided. There is abundance of good coal along the Hun Ho valley route, and of course no traffic would be lost, as little comes through the Nan-k'ou pass that does not come to Hsüan-hua first.

I understand that the reason for selecting the Nan k'ou route was that it would be easier to overcome the prejudices of the Chinese. But the day is quite past when the alignment of a railway in China should

be allowed to depend on the idiosyncrasies of the local inhabitants. There are now far too many enlightened Chinese for that sort of thing. Of course these objections are often merely a cloak for gain, and the railway engineers prefer to go round and take up cheaper ground than pay the exorbitant sums demanded for groûnd along the best alignment. But surely the time has come when the leaders of 400 million willing workers and really intelligent people should see to it that the future prospects of their country are not sacrificed to the grasping selfishness of a minority of the present generation.

Railway construction in the loess is not easy, but once the metre-gauge line from the Pei-han railway at Chêng-ting Fu to T'ai-yuan Fu is completed, the unexplored recesses of Western Shan-hsi and Eastern Shen-hsi will be brought within easy range, and a shooting trip to the Alashan will have lost half its charm and excitement. Railways, which are badly needed in North China, are one from Tientsin to Pao-ting Fu, and another from Tientsin to C'hi-nan Fu.

The Central China Region.

Of railways in the Central China Region there are almost none. The Pei-han connects it with the north, and a line is constructing from Shanghai to Nanking, but the bulk of the trade in this region is along a general north-west and south-east line, and *vice versâ.* There was much talk, when I was at Wuhu a year ago, about a line from that treaty port to Kuang-tê, on the Chê-kiang border, and the chief promoter was Lord Li, the adopted son and successor of the great Li Hung-chang. Such a line may be needed, and may pay, but more urgent ones are from Wuhu to Hui-chou Fu, and from P'u-k'ou (opposite Nanking) *viâ* Lü-chou Fu to Ch'eng-yang-kuan, and thence to K'ai-fêng and the Yellow river *viâ* Chou-chia-k'ou.

In connection with railways, I should like to see steps taken to improve the navigation of the Grand Canal between Yang-chou Fu and Ch'ing-chiang-p'u, and the construction of a short length of new canal (easily accomplished, as there are already waterways) to connect the Huai *before* it enters the Hung-ch'ih lake with the Grand Canal, and thus enable large boats and small river-steamers to navigate this splendid waterway right up to the Ch'eng-yang-kuan, and even beyond.

At the conclusion of a journey from Hankow to Bhamo, in Burma, in 1898–99, I drew up a memorandum concerning railway construction from Burma into China, in which, I remember, I strongly urged the desirability of stopping the work on the Mandalay to K'ün-lung line at Lashio, in order to provide funds for a line from Bhamo to T'eng-yüeh. This recommendation was supported by the acting engineer-in-chief in charge of railways in Burmah, and given effect to later by Lord Curzon. The late Mr. Litton, whose untimely death all geographers will lament, when consul at T'eng-yüeh, was of the same opinion as myself in regard

to this matter. I am glad to find a fresh and quite independent opinion in a report dated June, 1906, by Mr. Ottewill, who succeeded Mr. Litton as our consul in Western Yün-nan. He writes:—

"The remedy for the want of good communications is the building of a railway from Bhamo. . . . There is every chance that even a short line to T'eng-yüeh will pay its working expenses, and leave a margin for profits. . . ."

My contention was this: not that a railway from Burma to Ssŭ-ch'uan cannot be made, nor even that it should never be made, but that such a railway is before its time. First, we should look to see a line from Shanghai (or Hankow, at any rate) to Ssŭ-ch'uan,

VIEW LOOKING EAST FROM WALL OF HSIU-NING CITY.

because a railway line, or, indeed, half a dozen lines, from Ssŭ-ch'uan to Burma (or Tonking either, for that matter) will never divert to Rangoon or Haiphong a single waggon-load of goods that can go to Hankow or Shanghai. My reason for wishing to see a line to T'eng-yüeh quickly made was that it would tap nearly all the existing trade of Western Yün-nan, is on an old and well-established trade route, and that no particular harm is done even if, as may quite possibly be the case, it prove commercially impossible to push it further west. Possibly it might some day continue northwards. About this latter point, no doubt, Mr. E. C. Young, the most recent explorer in those regions, will be able to tell us something. In any case, it would be a feeder line to serve the Burma railways much in the same way as

do those which run up from the Bengal trunk line against the wall of the Nepalese State.

I agree with Mr. A. J. Sargent, who, writing in this Society's *Journal* of June, 1905, advocates caution in embarking on trans-continental lines through countries which do not afford much prospect of development along the line of rail. Short lines, to and fro between the best water-communication, are what are wanted in China before undertaking costly and possibly unremunerative trans-continental railways, unless it be to develop a newly acquired territory where no proper water-communication exists, and with a growing community at either end. Such a railway would be that to connect the Lower and Upper Yangtzu basins.

China is unlike North America in one respect—it does not lack population, and there is not the same amount of waste land and virgin forest to develop. Consequently there is not the same urgent necessity for through goods traffic as in America, where grain and lumber produced by a few people require to be transported quickly great distances to find a market. What the Chinese want is quicker and cheaper transit between important local centres. For instance, it is the short 29-miles section (from T'ang-ku to Tientsin) of the 500 miles of line between Peking and Hsin-min Fu which yields 75 per cent. of the returns on the imperial railways of North China.

What is true concerning railways in China is true of all enterprises. The Chinese cannot afford to spend a large sum of money all at once. Their capital is small, their realizable assets few. All their wealth lies buried in the future. They have to earn more before being able to spend more. Had concessionaries been less ambitious in their undertakings, things might have gone more smoothly. All the railways now constructed, or constructing, had small beginnings.

Railway and mining enterprise in China seems to me to have been too ambitious, too neglectful of the old adage about the tortoise and the hare. When first I began to be interested in things Chinese, eight or nine years ago, the two projects I heard most about were a railway from Peking to Hankow (over 700 miles long), and another from Mandalay to Ch'eng-tu, anything over 1500 miles in length. True, the former line is now a *fait accompli.* There were only two big bridges to construct and one short tunnel; the rest was level plain. It is a magnificent undertaking with its bridge over China's Sorrow, by means of which goods and passengers, that under the old *régime* would occupy a week or more and an army of men to convey, are now carried across in five minutes. But the history of the Pei-han is exceptional, and led to its quick—I had almost said hasty—completion. The alignment chosen in haste may yet prove not to have been the best.

A good deal of adverse criticism has been passed on the screw-pile bridge which for 3 kilometres spans the Yellow river. Though in

outward appearance a light and airy structure, I fail to understand why it should not, under normal conditions, continue to do the work asked of it, though capital outlay may have to be continued for some time longer. Personally, I am full of admiration for this spirited piece of engineering work in the heart of China, offering, as it daily does, a practical object-lesson to the Chinese of what they can do and have in their own country, provided they will exercise a little self-control, self-denial, and common sense.

The mistake made is in not starting "right there" (as our American cousins would say), with a few miles of line from the sea, or the head of navigation of some important waterway, to complete a line of communication. The most important bulky articles which Chinese railways have to carry are coal, timber, salt, beans, rice, and cotton. They will not at first be able to compete against good water-carriage for these staples (at least, not with a proper system of taxing goods), but they can start where this ends, and eventually what will happen has been demonstrated on the Pei Ho, which has quite ceased to convey the traffic to and from Tientsin and Peking.

In 1878, or thereabouts, Mr. Kinder built a little bit of a line to carry coal from the mines at K'ai-p'ing to the head of water-communication with Tientsin, a distance of a few miles. That railway has been since extended in both directions, until one end is at Peking, and the other termini are close to Mukden and at Newchwang. Somebody—I don't know who—started similar little bits of line from Wusung to Shanghai and P'ing-hsiang to Li-ling. The first will soon have its other end in Nanking (it would have been there long ago had the pioneer line been made from Shanghai to Su-chou instead of from Wusung to Shanghai), while the P'ing-hsiang line has reached that great waterway the Hsiang-t'an, and no doubt it will soon go further from both ends. Now, of these three, the first pays 5 per cent. to the bondholders, and the balance pays the new army; the other two will also pay well. They are commercial lines—not political or strategical. The Pei-han line is an example of a "through" line; it will certainly pay its way one day, as will almost all sensibly constructed lines in China, but not for some years.

Commercial Geography.

This subject is beyond the scope of my present paper. I will only say that, although there is plenty of room for development, yet the people are poor; by which I do not mean starved, or lacking the absolute necessities of the simple life, but not possessing capital sufficient to purchase expensive articles, which at present they have not yet been educated up to the standard of feeling in want of. Something should be done to foster cattle, sheep, and horse-rearing in Outer Chih-li and the K'ou-wai; there is money in it. If the Chinese are going to

take to milk (tinned or fresh) as they have to kerosene oil, opium, and cigarettes, there should be millions in a Mongolian cattle-ranch.

There is a good deal of gold and silver in Outer Chih-li, besides coal, which will eventually prove workable, I think—I mean, of course, by Chinese, not foreign companies. Much of the gold is not worked, because, after paying royalties and local taxes to the Chinese interested, there is not enough left to divide among the foreign shareholders. As is well known, China is one vast coalfield; one can march for days literally on top of the coal. There is no doubt about the quantity, and, I believe, quality also—at any rate, of the coal deposits along the borders of Shan-hai and Chih-li, and in north Ho-nan and in Hu-nan and Ssŭ-ch'uan. Some day, of course, the Chinese will burn coal and make gas like other civilized countries, and then all those lucky people who own coal-mines will become millionaires. Possibly, too, they may discover kerosene oil —then where, I wonder, will the Standard Oil Company come in?

In China things move slowly but surely. Profits are small, but must be reckoned in millions. If an article can be sold in China at a profit of only one-tenth of a penny, it is just a question of the number of Chinese who will use it, whether it pays or not to import it. They want cheap things, not because they do not like dear things, or because they are unable to tell the difference between a good and a bad article (they quickly learn that), but because they simply do not possess the wherewithal to purchase the better article; nine-tenths of the people live simply from day to day. They are taking to cigarettes like other people, and in a decade or two (in China one speaks of a "decade" rather than of a "year") Chinese men and boys, and half the Chinese women and girls, will smoke anything from one dozen to one hundred cigarettes per diem. The interesting point to foreigners is, will these articles be home made?

In Northern China the people will, not improbably, also become beer and wine (grape) drinkers, and will likely manufacture these beverages themselves. Within the boundaries of their empire they have everything a great nation needs, except indiarubber and kerosene oil. They may yet discover how to produce locally these necessities also.

In Central China, on this last journey, I found everywhere in the interior a very rough and strongly made cotton-cleaning machine of the simplest construction, worked by the foot. It was a Japanese manufacture, and cheap, costing only £3 10*s.* to £4 10*s.* even in out-of-the-way mountain districts, removed from water-communication. There is room for similar rough and cheap semi-modern machinery of this nature, for agricultural and farm uses and for purposes of irrigation. The Chinese are not yet nearly ready for the wonderful machinery which we find listed in the catalogues sent to our consulates in China for distribution in the interior. Be it noted, these catalogues are more often than not in the English language. On the cotton-cleaning machines were nothing but Chinese characters.

Chinese Character.

To the end that we may obtain a materialized conception of the Chinese unsearchable mind, some people tell us that we should first stand on our heads and then think backwards. But it seems to me the best way to try and understand it is to realize that the Chinese are (that is, the great bulk of them) still where Confucius left them more than 2000 years ago. What, I ask, was the condition of Europe then, or even of England only 500 years ago? Now, my experience of the Chinese

SOME SPECIMENS OF HUI-CHOU SCULPTURE, PARTLY DESTROYED BY T'AI-P'INGS.

man in small things has been that once he decides to undertake a business he goes through with it to the end: not, maybe, exactly as we would, nor as we should like, nor perhaps in the best possible way, but in the long run he gets there somehow. Let me give an illustration which relates to geography. I was about to undertake a journey of many months' duration, and I wanted to make a plane-table traverse of my route. I wished to find some educated Chinese who could do this plane-tabling

for me, so that I might be free to attend to other matters. This was some years ago; and where now you might find a hundred such men, then they were *raræ aves*, especially at the somewhat low rate of wage I was able to afford. Eventually, however, through the kindness of an American gentleman, I secured a really delightful young fellow, full of life and energy, but to my great grief he knew nothing of plane-tabling. When I pointed this out to him, and said I thought he might not do on that account, he said, "Oh, I can learn." And learn he did, so quickly and well that within a fortnight he was able to commence the route-traverse on a scale of 2 miles to 1 inch, and (although it seems incredible) that fragile, delicate-looking Chinese gentleman continued plane-tabling for over 2000 miles, up and down mountain and valley, over most difficult country, often unhealthy and feverish, through every degree of temperature and all conditions of weather, yet he never omitted a village or hill which he could see, nor a stream which he crossed, nor laid aside his plane-table for a single day, except one day when it snowed too heavily for work. So much for a reformed Chinese Christian, for even as he never ceased his work, neither did he ever omit each night, no matter how wearied or how late the hour, to read his Bible and say his prayers.

One more example. Several instances of the value of Christian ideas, when they have properly taken root in the Chinese character, have been cited in connection with the "Boxer" uprising in 1900. I will only refer to one man, but to him in no small measure is due, so far as the British are concerned, the happy ending of the siege of Peking by the early entry of the British troops through the Water-gate, for he was, among our guides, almost the only reliable one we had. Owing to my previous knowledge of North China, I had been selected to assist in the advance to Peking, and it was my daily duty to obtain information concerning affairs in the front and regarding the routes to be followed, etc. My guide, comforter, and friend throughout that trying fortnight was a Chinese Christian, one of the first to try to take a message to Peking, but who, failing to obtain entrance to the Legation, had returned, twice running the gauntlet of the Boxers. Nothing daunted, he would have again essayed the dangerous task, but I kept him to act as my orderly. I had no servant, so he did everything for me. I had two ponies, a bay and a grey, which we rode each day alternately, but he often volunteered to ride the grey all the time. He never tired, and never left me, and risked his life often. To my great regret, he died in 1903 at his home. "A little leaven leaveneth the whole," and Sir Robert Hart may be not far from the truth in the horoscope he has cast for the Chinese; only I do not think they will be Boxers.

Who, after such examples, will prophesy what the reformed Chinese shall not accomplish? Ten years ago such men were not common, now there are hundreds—nay, perhaps thousands like them. I hold no brief

for the Chinese. I take them as I have found them, good, bad, and indifferent, much the same as the people of any other country, but I will say this—that in some great essential virtues they certainly excel. It is these very virtues which Western civilization may, in its frantic efforts to force upon them all its good things and some of its vices, destroy. These old-world charms of character, to call them nothing else, may be stifled. They are—reverence for parents and age, sobriety of conduct and demeanour, temperance; cheerfulness under adverse conditions, bravery in the face of death; and, lastly, business integrity. I might even add, in this strenuous time, a complete absence of "nerves," and the power to sleep in any position or under any circumstances. There are, of course, numbers of people who know the Chinese far better than I do, and they will perhaps not altogether agree with me in my estimate of their virtues, especially where it concerns bravery. Well, the Chinese are in this respect a contradiction in terms. During the last hundred years or so, the soldiers have taken to running away when faced by the soldiers of a resolute enemy, but I do not think it was fear of being killed which made them fly. It was, first of all, a desire to live; because, not having been taught otherwise, they could not see any particular use, or advantage that would accrue to themselves, or any one else by getting killed. Next, it was a belief that, if killed, or wounded and left on the field, they would be mutilated, and arrive among their ancestors in this condition. This belief may seem absurd in this twentieth century, but it is so real to the Chinese, that they will pay large sums of money to ensure going out of this world in a whole condition of body.

China's Twentieth-century Army.

This brings me to the question of the value of China's new army as a fighting machine—potential, not present value. No army in modern times will fight except for a cause which appears to the bulk of its soldiers a just one; one in the interests of their own hearth and home. The more intelligent and civilized an army is the more is this the case. If this be true of other nations it is doubly true of the Chinese, for to them "home" means all, everything worth living or dying for. It is represented by the character "chia," which is composed of the character for "pig" placed underneath that for "roof." This may seem to us a poor conception of home, but was ours any better, I wonder, two thousand years ago? Chinese ideas of home are the same now as then. They change their ideas slowly. Consequently, before one can expect a Chinese army to stand and fight to the death, each soldier (or at least a majority) must see clearly that it is his interest to do so—that he is fighting for the existence of his hearth and home, and, through it, for national existence. At present they are far from comprehending this. At learning drill, manœuvres, military

exercises, and all about modern warfare they are adepts. Under favourable conditions, they quickly acquire the proficiency and accuracy of the German Imperial Guard on the parade ground; while at examinations for fitness for command, or at military sketching, reconnaissance, etc., they soon learn to excel. What they lack individually is the will to fight for what, hitherto, has been to them an incomprehensible object. As an army their fighting value is still inconsiderable, because of divided interests, and the corrupt and inefficient way in which an excellent system is worked. But it will be several decades before the Chinese are able to grasp the full meaning of the Japanese soldier's maxim—"Watakushi wo sareti oyake ni hozuru,"—the casting away of self to save the commonwealth.

Conclusion.

I have now completed a rough and wholly inadequate sketch of some recent British explorations in Northern China and the Eastern Part of the Central China Region. Though only a tithe of what has been accomplished has been mentioned, it is, I hope, sufficient to show we have not been idle. The results of the survey work are being used in the compilation of the one-to-a-million map of the Chinese Empire, on which Major Close has been for some time engaged, and several provisional sheets of which I have been enabled, through his and Captain Fraser's kindness, to exhibit.

Among those travellers who have recently contributed to our geographical information concerning Northern China are not a few Fellows of the Royal Geographical Society—Campbell, Bruce, Young, Kidston, Russell, Hedley, Pereira, Woods, Maguire, Webster, Doveton, McCleverty, Turner, Gunter; while there are others, such as Goold-Adams, Mahon, Williams, and Leake, who, I regret to say, are not Fellows.

All, or nearly all, these explorers have been assisted by Indian surveyors. Our thanks are due to these silent workers, who have done so much to fill in the blanks on our maps of the Chinese Empire, and several of whom have lost their lives in the work.

Another who, though he may not have taken latitudes and longitudes, or determined the exact heights of hills, has contributed, as a Fellow of this Society, towards the sum-total of Chinese geography, is the *Times* Peking correspondent, Dr. G. E. Morrison, to whom not a few travellers are indebted for assistance and for the use of his unique library relating to Eastern Asia.

My remarks concerning our topographical work in Inner and Outer Chih-li would not be complete were I to omit to record the harmony which ruled among topographical sections and travellers of the many nationalities in North China, and the truly international spirit which influenced those engaged in the work, by which mutual exchanges took place, adding to the general knowledge and facilitating the work.

But perhaps the brightest side of this geographical work in China is that we received valuable assistance from the Chinese themselves, both officials and people, who seemed quite able to understand that topography and geography did not necessarily mean gunboats and howitzers!

May I here interpolate a word on behalf of the much-maligned Chinese Government? So far as I have been able to observe, whenever it has been approached by travellers *bonâ fide* in search of information of a scientific character, it has invariably rendered a free and generous assistance.

What I have experienced in this connection leads me to believe that

EN ROUTE FROM TZU-LI HSIEN (IN HU-NAN) TO WAN HSIEN (IN SSŬ-CH'UAN).

the time seems opportune for the institution of a Chinese Government Survey Department, which would do for China what hitherto other nations have tried—somewhat inadequately, perhaps—to do for her. There are now quite a number of capable Chinese surveyors; quite sufficient to make a start with.

Then, with a Chinese Imperial Geographical Society, we should be released from the great burden of trying to map the third biggest empire in the world, instead of letting its 400 million people do it for both themselves and us. The Japanese have, I believe, a Geographical Society, and it does seem a pity that such a literary people as the Chinese should be without one. I think they should be approached on this subject.

To those who have fears that the Chinese cannot take care of themselves, I would recommend the perusal of the latest work on the subject, entitled 'The New China,' by an American author, Mr. Millard. I have selected the following quotation from his work with which to conclude this paper. He writes, "It is difficult to conceive how Japan, with scanty natural resources, will be able to industrially and commercially overtop a country like China, upon which nature has lavished her favors, and where an intelligent, capable, and industrious people are ever ready to apply their activities. What reason is there to warrant the opinion that, in a prolonged industrial and commercial struggle, China—with a land of unsurpassed fertility and vast extent, with undeveloped mineral resources of incalculable variety and value, with willing and efficient labour in any quantity, and with immense capital of her own—will be distanced by a competitor like Japan?"

Before the paper, the PRESIDENT: I note the presence here of a good many visitors and Fellows of the Society whom I am sure we shall wish to join in the discussion, so that I do not propose to occupy your time with introductory remarks, especially as Colonel Wingate's eight or nine years' work in China is well known by the general public. The only thing I shall say is to remind you that some years ago he contributed a very valuable paper to our *Journal* on his noteworthy journeys of 1898–1899 through China to Burma, which paper I think some of you will like to read after you have heard his paper to-night, and I will therefore remind you that it is in vol. **14** of our *Journal*. I will now call upon Colonel Wingate to read his paper.

After the paper, the PRESIDENT: I received a letter this morning from Lord Curzon, who is in the country, expressing his regret that he is unable to attend here to-night to hear Colonel Wingate's address, otherwise I should have called upon him first to open the discussion. But we have here to-night the late very well-known Minister of China, who is now ambassador in Japan, Sir Claude Macdonald, who must, I am sure, have felt strange emotions in looking at some of the photographs that Colonel Wingate presented to us. I believe Sir Claude is one of the few persons who has ever read his own obituary or possessed a ticket to attend his own funeral. I recall the last time I saw him on this platform, when he gave us an interesting address, about fifteen years ago, on the Explorations on the upper Benue.

Sir CLAUDE MACDONALD: At the request of Sir George Goldie, it gives me great pleasure to say a few words. Judging from a five years' experience of China, I can entirely endorse everything Colonel Wingate has said so far as the Chinese are concerned. I have always found the peasantry intelligent, thrifty, hard working, and friendly. With regard to the commercial classes, their reputation for probity stands very high; there is a phase of this commercial morality, however, which is interesting, which is common to most classes, and which, with your permission, I will illustrate by a short story told me by my friend Sir Robert Hart. He said that in his earlier days in the Imperial Maritime Customs he was promoted from the post he then held to a somewhat higher one, and his salary was raised in consequence. His head "boy" was a most excellent and honest individual, who took a fatherly care and interest in his young master. Sir Robert noticed, however, that when his salary was increased, his weekly bills also rose. On expostulating with his boy, he was met with the surprised answer, "Master get chancee, boy must get chancee too."

Some of the pictures shown upon the screen to-night have brought to my mind reminiscences of the siege of the Legations in 1900, and notably the picture of the water-gate, through which the British troops entered the Legation quarter and effected our release. A detail of that entry through the water-gate will, I think, interest you. Colonel Wingate has said that it was through my foresight that the troops were able to get through that gate; this is not altogether correct, because my assistant on that and many other occasions was a great friend of mine, an American cavalry officer, Squiers by name, who subsequently became the first American Governor of Cuba. He came to me when the relieving forces were close at hand, and produced a map of Peking, not unlike the one which has been shown upon the screen, and pointed out that if the troops could come over the wall of the Chinese city and advance through this city, they would be able to enter the water-gate into the Legation quarter. Two copies were made of this map, and sent, with directions, in the sole of a Chinaman's boot, to the American and English generals respectively; the directions stated that the position of the water-gate would be marked by three flags, the centre one, a Union Jack, being hoisted on the Tartar city wall immediately above the gate. Early in the morning of the day we were relieved (August 14), I received a message from the chief of the staff to say that the centre flagstaff had been shot away, and the flag was hanging over the wrong side of the wall; he added that if I would send somebody to mend the staff, he would get it reboisted. I at once despatched a bluejacket carpenter, who with his pal, a signalman—the latter with his two signal hand-flags—very quickly mended the flagstaff, and also stopped on the top of the wall to see the fun. Following instructions, our troops worked their way through the houses and narrow streets of the Chinese city, meeting with but little opposition. When they came to the end of the houses, they found an open space about a hundred yards across, separating them from the Tartar city wall, on which they saw the three flags, which, however, were hanging in straight folds. There was a death-like stillness, and our troops hesitated because they thought there was treachery, and that this was only a plot to lure them into the Tartar city. Suddenly, close to the centre flagstaff, they saw a small flag violently "wagging," and spelling in the Morse alphabet "Come in here"! This was my friend the signalman, who had seen their hesitation and had waved this message. With a cheer, our troops charged across, dashed through the water-gate, and were first into the Legation quarter. Well, I am sure it will interest you all to hear that directing this little party and acting as its pilot was our lecturer of to-night, Colonel Wingate. In conclusion, a word about Japan. As your President has told you, I have the honour to represent His Majesty at the court of the Emperor of Japan, and I would take this opportunity of saying how much I love the country and its sympathetic and chivalrous people. Our alliance with Japan has been criticized by some. You will have doubtless seen what the President of the United States in his recent message to Congress has said about our allies; if what he says is correct—and personally I endorse all of it—I venture to think, to use an English expression, that we have put our money on the right horse.

After some preliminary remarks, Lieut.-General Sir EDWIN COLLEN said that he wished to lay emphasis on the fact that we, as a nation, were responsible, with Japan, for the peace of Asia, for the independence and integrity of the Chinese Empire, and for the principle of the "open door." We knew what Japan was doing, but what were we doing, on our part, to take up the burden of our responsibilities? He was well aware that the Society was doing a great work in focussing the information obtained by explorers, but we wanted more knowledge, and to bring it home to larger numbers. He entirely agreed with the lecturer that efforts should be made for the establishment of a Chinese Imperial Survey Department. He

submitted that we needed, first, the production of good maps accessible to all, although he was aware of what had been done in this direction, as shown to them that evening; secondly, the gathering up of geographical and other information in a complete work or series of works on the geography of China. He referred to the good work of the Indian military surveyors mentioned by the lecturer, to the original conception of the "Guides" in India, and to later developments of Sir Henry Lawrence's idea. He submitted that we should maintain a strong intelligence department in China, and not allow officers like Colonel Wingate to drift away altogether into ordinary regimental life. Several years ago he had presided at a lecture given by Colonel Wingate at Simla, and had then said that his exploration and labours entitled him to a high place on the roll of honour for work in the Far East. He now ventured to think that the lecturer had doubly earned that distinction.

Sir Walter Hillier: I had no idea, when I accepted the invitation of the President of the Society to attend this evening's lecture, that I should be called upon to speak, and the summons to do so has taken me completely by surprise. I am, therefore, utterly unprepared with any remarks. There are so many things the lecturer spoke about in his paper which interest one, that it is very hard to pick out a single subject for criticism or remark; but one statement he made especially struck me, and it was the only one I will venture to question. It was that the Chinese remain very much in the condition they were in the days of Confucius. Well, I must humbly beg to differ from him in this respect. He has come recently from China, and knows a great deal more about it and its present conditions than I do; but I happened to return there last year for a few months after a long residence in the country, and I think nothing struck me more than the wonderful progress the Chinese had made in every direction. I venture to think, before many years are over, we shall find, under the rule of the enlightened viceroy of Chihli, that China will take her place—I won't say on the same level as Japan—but that her progress will be such as to surprise the world. I quite agree with what Colonel Wingate has said as to China being able in the long run to hold her own. We hear a great deal about the Japanese commercial invasion of China, but I am quite certain that the Chinese are astute enough to carry on their business in their own way, and to learn what they want from Japan, but not to take more from her than they require. I will not detain you longer with remarks on any other subject except to express the opinion, with which I am sure everybody will agree, that we have listened to Colonel Wingate's paper with deep interest. I happen to know something about Colonel Wingate's labours, because I was with him at the time of the "Boxer" rising at Peking, and I know what he has refrained from mentioning, viz. the immense amount of work he did, the hardships he has undergone, and the great pluck he has shown in visiting almost unknown parts of China.

Mr. Byron Brenan: The discussion which follows the paper, I think, is always more interesting if the subsequent speakers can differ a good deal from the lecturer, so with that object in view I listened most carefully in the hope I should be able to pick some holes, but I am sorry to say there are very few points upon which I can lay my reproachful finger, but I will try to do my best. The lecturer, whilst deprecating the views some might hold that it is rather a waste of money to perform services for the Chinese which they are capable of performing themselves, seemed at the same time to hint that it would be rather a graceful act on the part of the Chinese if they would more fully appreciate what we are doing for them. I quite agree that it is not a waste of money, but it would be a waste of time to try to persuade the Chinese that our object is entirely altruistic. Some years ago Japan did some very good survey work in Manchuria in a very unobtrusive manner, so much so that she

had accomplished her work before anybody knew she was at work at all. When the China-Japanese war broke out, she knew more about the country between Corea and Peking than did the Chinese themselves. In the same way some people have taken a great deal of trouble and spent much money in making surveys of possible railway routes and prospecting for minerals, but it would be very difficult to persuade the Chinese that they are animated by motives of pure philanthropy. It would be out of place, in such a Society as this, to enter into the reasons why China would be ill advised to give railway concessions to foreign capitalists. A foreign-owned railway in any country, managed and controlled by aliens who with their railways are above the law of the land, is an anomaly too flagrant to need comment. I don't quite agree with the lecturer when he says China is too poor to construct her own railways. The money is there, but it is not forthcoming, and it will not be forthcoming until the Chinese people have some confidence that the money will be honestly spent, and the earnings of the railway will go into the pockets of those who provide the wherewithal. The obstacles which railway development in China have to overcome are not so much the rivers and the mountain ranges, about which we have heard to-night, but the hesitation, the fear of the Chinese people that they will not receive fair play at the hands of their Government. The fact that a contract entered into with a foreigner is considered by the Chinese Government to be more binding than a contract entered into with their own people is the reason why it is now necessary to go abroad for money, and that is a reproach on the Chinese Government which it rests with them to remove. The lecturer referred to the good feeling he found everywhere amongst the people, and the good reception he met with. It has been my pleasure to know Colonel Wingate in China, and see him at work, and I am sure if every explorer possessed the same tact and the same patience and the same kindly feeling towards the natives, we should never hear of any regrettable incidents.

Major Close: I have only one remark to make. Sir Edwin Collen mentioned, as one of the things very desirable, the provision of maps of China. I have only to say that any one who wishes to get a map of a province of China has only to go to Mr. Stanford and pay half a crown for the latest War Office map that is published. They are not all published, but he will get the latest that are.

Major C. D. Bruce: I am afraid I am unable to offer to you to-night any either commercial or political information such as has been given by those gentlemen who have spoken since the lecturer finished. My own interest in Colonel Wingate's lecture is entirely with the work that he himself has done in North China in the last eight or nine years, that is to say, the map, and, if I may use the word, the intelligence work. Ten years ago, as he himself said, nothing practically was known—I speak under correction of the War Office—nothing practically was known of the area of which he has unfolded the history to-night. What has been done since that work began is due almost entirely to Colonel Wingate, whom I myself have known and worked with during the last eight years. The work he has done will not be appreciated yet; it may never be appreciated in this country, because, I am afraid, people in England do not yet take China seriously. When I say seriously, I mean we have not yet arrived at that pitch of sympathy which my long acquaintance with China teaches me we ought to have. We know the French, the Germans, but we do not know the Chinese at all, yet we have been connected with them through India many hundreds of years. Well, when we get hold of the idea that China is a country like our own, that the Chinese are human beings like ourselves, then, I think, we shall be on the high-road to understand them. At present one person who comes from China gives you one idea, another gives you another. My own idea is, if I may offer it, that if we

take them as human beings like ourselves, we shall soon be at the root of their difficulties, and sympathize with them. Colonel Wingate in his lecture referred to the Indian surveyors with whom and under whom, under his direction, most of his work was done. I can add very little to what he has said about the value of their work. In my own case, I had one with me who worked for many months under great difficulties, who went on day after day in high altitudes, night and day, badly fed, badly clothed, under conditions which, I am sure, no European could have stood, and I can only say that if my attitude to him had been all through what his was to me, I should feel more proud of myself to-night than I do. From the day we started to the day we got in he never had a cross look on his face, which is more than most Europeans can say. He belongs to one of the most valuable services which we as a nation possess—that is, the Survey Department of India. Colonel Wingate made some remarks about the Chinese surveyors he had with him. In one or two cases they were Christians. Perhaps it is a subject hardly fit to be entered upon to-night, but it is another point with regard to the Chinese that we can all try and get into our minds, that is, the Chinese Christian, when he does become a Christian, is frequently a very valuable man. In 1900, apart from the military trouble, which all began over the missionaries—though whether the missionaries were to blame or not, it is not for me to say—any one who knows what went on knows that the confidence of the missionaries in their Chinese converts was amply fulfilled. Such acts were done which probably in this country are hardly known of, by these Chinese Christians saving missionaries' lives, keeping them hidden for weeks and months, and all simply because they learnt what we had taught them. I have rather wandered from the point of the survey work, but I must now get back to it. I will say, in conclusion, that, although perhaps it is a controversial subject, if the War Office can find in the next ten years as many officers who know and understand the Chinese as well as Colonel Wingate does, and if they can send them out to China, the country will benefit very much by their presence there.

The PRESIDENT: I need not ask you to give a hearty vote of thanks to Colonel Wingate, for it has been quite evident that his address has not only been extremely valuable, but has also been extremely interesting to us all. I do not remember any evening that I have been here on which I have heard a more interesting lecture.

Colonel WINGATE: Were I to attempt to take up all the points on which the speakers have touched, and which have been most interesting, I should have to ask the President to suspend the 10-o'clock rule. For, as you know, the Chinese and China are like the river, they go on for ever. One might speak, not only for a few minutes, but for two or three weeks, or a month, and not exhaust the subject. Consequently, I am sure, you will forgive me if I do no more than thank you all for the very patient way in which you have listened to the few remarks I had to make; also, I should like to thank those speakers who have said such pleasant things of me, and which, I am sure, I do not deserve.

THE MOST RELIABLE VALUES OF THE HEIGHTS OF THE CENTRAL AFRICAN LAKES AND MOUNTAINS.*

By Captain T. T. BEHRENS, R.E.

Now that the surfaces of the three principal African lakes have been connected with each other and with the Indian ocean by a complete series of trigonometrical operations, it is time to compare the heights so obtained with those hitherto determined by barometer and hypsometer readings. In addition to the lakes, the principal peaks of the equatorial region of the African continent have been trigonometrically connected with varying degrees of accuracy: and it will be of interest to collect the various observations in one list, giving the heights with their probable errors. The heights we are now able to assign to the great summits will, at any rate, be consistent amongst themselves, and more reliable than previous determinations based only on barometric or boiling-point data.

The best determination for Lake Victoria at present is undoubtedly that obtained by the Uganda railway levels brought up from Mombasa. An error of 0·25 inch per half mile was permitted by the engineers, but if the two lines run between any two successive bench-marks exceeded this, the levelling was done over again. The bench-marks were placed at half-mile intervals. If the true probable error of the result varied as the square root of the length of the line of levels, that is to say, if all constant errors had been eliminated, the error of the result would be less than $\pm 0·75$ foot.

Previous experience would not justify us, however, in assuming so small a probable error. When we consider that no accurate determination of mean sea-level has been made, that it still remains to check the original level books to ascertain that the most probable result has been obtained from the observations, and to ensure the elimination of all arithmetical errors before the result can be looked on as scientifically reliable, we shall not probably be wrong in assigning a probable error of ± 3 feet to this value.

The range of oscillations of the lake-level in eight years, from 1896–1904, was 3·75 feet, so that for giving a figure to the mean level of the surface of the lake, we have a more than sufficiently accurate result. The zero mark on the lake gauge at Port Florence is 3720·15 feet † above mean sea-level at Mombasa. The mean level of the lake between 1899 and 1904 may be taken as 3720·3 feet $\pm$ 3 feet above mean sea-level.

A continuous series of trigonometrical heights have now been carried

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* Research Department, December 14, 1906.

† The Uganda railway levels are referred to a datum approximating to mean low water spring tides, hence 6 feet had to be deducted from the railway figures.

from Lake Victoria (by the Anglo-German Boundary Commission) to the trigonometrical points of the German Government's survey of West Usambara. It is to be regretted that, although this survey is very accurate in itself, it is nevertheless based on a barometric datum. In 1905, however, the southernmost point of this net, Genda-Genda, was found to be 1710 feet above mean sea-level at Zanzibar. The observations were reciprocal and simultaneous, and so most probably accurate. Unfortunately, the Usambara survey has no height for this point, so the triangulation from Lake Victoria has not a first-class connection with mean sea-level. Another series of less reliable trigonometrical heights was carried up from the Indian ocean to Kilimanjaro by the

KILIMANJARO FROM THE NORTH-WEST (THE NYIRI PLAIN).
(*Captain Behrens, photo.*)

Boundary Commission of 1892, and was carried on from points of this survey to Kenya and other peaks by the Sclater road expedition in British East Africa, 1895–97. The closing error of this work in a circuit of 600 miles was 25 feet.

The triangulation from Lake Victoria is, however, connected to the northernmost points of the 1892 survey, and gives us a connection of fair accuracy with the mean sea-level at Vanga. Using this line of trigonometrical heights, we find the level of the zero-mark on the Port Florence lake gauge is 3728·8 feet ± 18 feet above mean sea-level.

The largest portion of the probable error is due to the uncertainty of the heights between Vanga and Kilimanjaro. It is hoped that the German Government will shortly publish the height of Genda-Genda

KENYA FROM THE SOUTH-WEST.

(*H. J. Mackinder, photo.*)

referred to their Usambara datum. The height connection will then be trigonometrically homogeneous from Lake Victoria to Zanzibar.

The trigonometrical result, 3728·8 ± 18 feet, is very near the 3720·1 ± 3 feet of the railway levels. The weighted mean of these results gives 3720·4 for the zero mark. It would, under the present conditions, be impracticable to make so small a correction, and we may regard the trigonometrical value as showing that the railway value has been uninfluenced by any constant error of great magnitude.

On examining the fluctuation of the Victoria lake gauges, being careful to study the confused alterations of their zero-marks, we find that on January 7, 1903, the level of the lake was 3719·3 feet. On this date, from the west shore of the lake, a series of trigonometrical heights was commenced, which determined the heights of the peaks of Mount Mfumbiro, Kanyangungwe (the highest peak of Ruwenzori), and the surface of Lake Albert Edward in relation to Lake Victoria.

Accepting the lake-level on that date as 3719·3 feet above mean sea-level, we get the following results:—

	Feet.
Mount Ruwenzori, Kanyangungwe (the highest summit)	16,619 ± 7
Kanyangungwe, secondary peak	16,543
Mount Mfumbiro—	
Muhavura	13,562 ± 4
Karissimbi	14,683
Sabyino	11,881
Mikeno	14,385

	Feet.
The level of Lake Albert Edward on December 7, 1903	3,004
Height of station mark * on Mount Hunga	7,172

An examination of the errors of this series of trigonometrical heights leads to the adoption of the following probable errors for the heights as above determined :—

Lake Albert Edward	p.e. = ± 7 feet.
Muhavura	p.e. = ± 8 „
Ruwenzori	p.e. = ± 10 „

These probable errors are based on the consideration of the errors of the operations themselves, and would only be true if all sources of constant error had been eliminated. It is, however, useful for purposes of comparison. A recapitulation of all the heights will be found at the end.

The peak Muhavura was a main point in the triangulation of the German-Congolese Boundary Commission, and the differences in height between it and the levels of Lakes Tanganyika and Kivu have been determined trigonometrically. It has been impossible to obtain accurate information about this triangulation and its relative accuracy. Trigonometrical heights were carried from Tanganyika at its northern end to

MERU FROM THE SOUTH.

(*Uhlig, photo.*)

the southern shores of Lake Kivu. The level of Tanganyika was taken as 780 metres (2559 feet) above the mean sea-level. This appears to

* This mark is 2 or 3 feet below the ground, and is marked by the base of a brass cartridge case cemented cap uppermost in a large stone.

ELGON.

(*Sir H. H. Johnston, photo.*)

be an arbitrary datum taken from some map. A barometric or boiling-point height for Kivu was determined, and the mean of the two results was adopted as the height of the Lake. The height of Muhavura was then found by adding the trigonometrical difference in height between its apex and the water-level at the north end of Kivu to the height so determined. The trigonometrical difference was 672 metres (2205 feet) and the barometric difference 678 metres (2224 feet) between Lakes Tanganyika and Kivu.

We have then (3334 metres) 10,938·4 feet as the trigonometrical difference between Muhavura's apex and Lake Tanganyika. In giving this difference a probable error of ± 10 feet, a liberally large value has been taken.

Between Tanganyika and Nyasa two series of trigonometrical heights were run; the weighted mean of these results gives 979 feet ± 13 feet as the difference between the lakes.

We have, then, the following trigonometrical determinations:—

MUHAVARA	13,562 $\pm$ 7·9	
	− 10,938 $\pm$ 10·0	
TANGANYIKA	2624 $\pm$ 12·7	
	$\pm$ 2·0	(p.e. of transferring height by means of the surface-level of Lake Tanganyika from north to south end.)
	− 979 $\pm$ 13·0	
NYASA	1645 $\pm$ 18·3	

We can now examine the results obtained for some of the same levels by barometer or hypsometer, collecting all the known determinations of each together. Much naturally depends on how the heights were worked out, even if we could be sure that the instruments were carefully tested and handled in addition to being accurately read. It is impossible to attempt to give a weighted mean as the result, for the original data are scarcely ever available. Travellers have mostly contented themselves with publishing bare figures, often without any hint as to the methods by which the results had been arrived at.

The summary is at the best rough and unscientific; its interest lies in showing the comparative accuracy of the African travellers' barometric and hypsometric results when compared with the results of observations of comparative but not geodetic accuracy, correctly computed and carefully checked.

The errors of a boiling-point determination are well known, but it will be useful to recapitulate them here. They are as follows:—

(1) Error of thermometer reading when checked against standard.

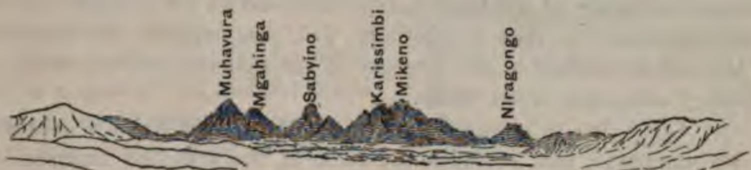
RUWENZORI: MOUNT STANLEY.

(*Signor Sella, photo.*)

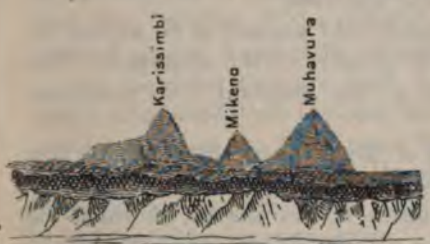
This error alters as the thermometer gets older, and makes it necessary to test thermometers both before and after an expedition. The alteration is due to gradual changes in the form of the glass of which the thermometers are made.

(2) Error in reading the scale.

(3) Error due to the correct boiling-point not being obtained round the bulb of the thermometer.



"DIE 'CENTRALSPALTE' MIT DEN MFÚMBIRO-VULKANEN VON GOHALI YA IVÍNSA AUS GESEHEN." ('MIT EMIN PASCHA INS HERZ VON AFRIKA,' STUHLMANN.)



VIEW OF UFUMBIRO MOUNTAINS FROM NEAR MTAGATA HOT SPRINGS ('THROUGH THE DARK CONTINENT,' STANLEY).

VIEW OF MOUNT MFUMBIRO, SEEN FROM RUMANIKA'S, KARAGWE ('JOURNAL OF DISCOVERY OF THE SOURCE OF THE NILE,' SPEKE).

MOUNT MFUMBIRO; OUTLINE AS SEEN FROM 1° S., 30° E.

(*Captain Behrens, sketch.*)

(4) Error due to alteration in boiling-point when the water contains salts in solution.

If all these errors have been reduced as far as possible or eliminated, it is easy to find the pressure of the atmosphere by looking out in a table the pressure at which pure water boils at such a temperature. These tables have been constructed from the results of direct observations. The pressure is given in terms of the height of a column of mercury at standard temperature at sea-level in lat. 45°. By this means we have then arrived at the pressure of the atmosphere at the observing station in terms of a standard measure.

Before arriving at the same result with a mercurial barometer, we have to contend with the sources of error enumerated below:—

(1) Error of the barometer when checked against a standard. This includes (*a*) errors of graduation, (*b*) compensation for expansion of the scale compared to that of mercury, (*c*) compensation for difference in level of the surface of the mercury in the reservoir, (*d*) correction for capillary attraction in the tubes.

(2) Error due to obtaining an incorrect value for the temperature of the mercury; this includes the error of the attached thermometer when checked on standard.

(3) Error due to the alteration in the force of gravity, (*a*) in different latitudes, (*b*) at different heights above sea-level.

When these errors have been taken into account as far as may be, we are in a position to compute the pressure of the atmosphere from the observed quantities in terms of the standard unit mentioned above.

The determination of the height of the point of observation is now made in one of two ways: (1) By comparing this pressure with pressures observed simultaneously at some station not too far off, of which the height above mean sea-level is known; or (2) by comparing it with the best value known or assumed for the mean pressure at the nearest point on the coast for that season of the year.

The latter method is at the best a very rough one, and may cause errors of hundreds of feet. The first method may involve errors of many tens of feet if the observations at the base station are not simultaneous, and the correction for diurnal wave be omitted. The difference in height between the two stations is then measured, assuming a certain state of the atmosphere between the stations.

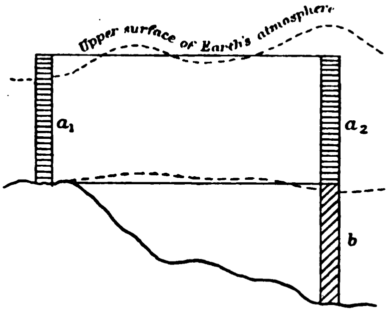
The temperature of the intervening column of air is supposed to be that of the mean of the air-temperatures at the two stations, and on this assumption the height of the column of air between, which is necessary to produce the observed difference in pressures, is calculated. As a refinement, a correction for the variation in the force of gravity, on a vertical and in latitude, is made.

Minute theoretical corrections are, however, of little use for practical purposes, as our assumption is not justified by facts, except within very wide limits. That is to say, the errors due to supposing such a state of atmosphere to exist between the two points entirely swamp all the other errors which we have not been able to eliminate by the correct reduction of the accurately observed quantities.

The factors of local climate and surface conformation, and the fact that it is not a problem of statics but of dynamics that we have to solve, fully account for the uncertainty of heights determined in this way.

A graphic representation of the problem is shown in the accompanying

figure. We have the weight of the columns of air a_1 and $(a_2 + b)$, and we assume that the weight of b is correctly represented by $(a_2 + b - a_1)$. Assuming an arbitrary state of the atmosphere in column b, we then determine its height.



The atmosphere is, however, not in a state of rest, and the upper surface would generally be represented by some irregular surface, as indicated by the dotted line in the figure. The surfaces of equal pressure are all in reality irregular, and the densities of the different parts of column b cannot be estimated with certainty.

At the same time we must not overlook this, that many errors, easily eliminated, have not been taken account of in travellers' published results; and as we have never had the *complete* data given us, from which the correct results of the observations might be recomputed, we cannot regard the travellers' results which are collected below as being uninfluenced by constant errors.

In this connection it will be interesting to quote a few words from a letter I received the other day from Dr. Kohlschütter. He kindly sent me in advance his computed results of the latest scientific barometer and hypsometer observations on the great lakes. After long and careful examination of the great quantity of material now available in the German East African colony, he has, I understand, introduced some alteration into the formulæ employed before, so as to bring the results more nearly into accord with the local effects of climate and the known difference in heights of the stations, where such were known. His results are given below, but not of course included in the general mean. A paper explaining his formulæ and results is already in the press, and will shortly be published.

Speaking of the residual discrepancies after applying all possible corrections, but using the original formulæ, Dr. Kohlschütter says, "It is a fact that the barometer heights in East Africa are very considerably affected by climatic factors. For instance, at Tabora in the course of a day the results of determinations at different hours have a range of 160 feet, and the monthly mean height even has an amplitude of 160 feet in the course of twelve months. The variations of the barometric height of Tabora, in consequence of the combination of these systematic and regularly recurring climatic changes, have an amplitude of about 325 feet. On the great lakes these factors have less effect, but even here the effect reaches about 200 feet. . . . . The differences between the different determinations after eliminating the climatic errors are small, and a single determination then has a mean error of ± 33 feet. This

error, the true mean error to be expected due to the accidental errors of observation, bears *no comparison* to the errors produced by climatic factors."

I have ventured to quote this *in extenso*, as the remarks have such an important bearing on the subject, and trust that Dr. Kohlschütter will pardon the liberty thus taken.

APPENDIX I.

Barometric and Hypsometric Heights collected from all Sources.

Note.—It has been found impossible to separate the barometer, aneroid, and boiling-point determinations in the travellers' records.

Lake Victoria.

	Feet.	
Speke	3740	Range between different readings, 600 feet.
Stanley	4058	10 observations, calculated by Zöppritz.
Stuhlmann	3921	
Baumann	3904	
Pearson	4002	
Mackay	3500	
Thomson	3705	
Gedge	3900	
Macdonald	3820	
Scott-Elliot	3850	
Mean	3840	
Dr. Kohlschütter	3724	

Lake Tanganyika.

	Feet.	
Burton	1844	
Stanley	2790	18 observations, p.e. about ± 20 feet, calculated by Zöppritz.
Hore	2700	
Cameron	2709	
Stairs...	2690	
Wissmann	2670	
Popelin	2663	
Baumann	2897	
Reichard	2558	
Scott-Elliot	2712	
Mean	2623	
Dr. Kohlschütter	2566	

Lake Nyasa.

	Feet.	
Kirk	1522	
Stewart	1629	
Anglo-German Boundary Commission—English party	1682	
Do. do. German party	1565	
Mean	1599	
Dr. Kohlschütter	1565	One year's barometer readings.


EAST CENTRAL AFRICA
to illustrate a paper by
Captain T. T. BEHRENS, R.E.
Scale 1:15,000,000 or 1 Inch = 237 Stat. Miles
Heights in feet
Albert Nyanza
Ruwenzori
L. Albert Edward
Mfumbiro
L. Kivu
Victoria Nyanza
Kagera R.
Entebbe
Pt Florence
Elgon
Kenya
Kilimanjaro
Meru
L. Natron
L. Manyara
Mombasa
Pemba
Zanzibar
Dar es Salaam
West Usambara
Tabora
Lake Tanganyika
Lukuga R.
Malagarasi
Ugala R.
Rungwa R.
Ruaha R.
Rufiji R.
Lufira R.
L. Mweru
L. Rukwa
Luapula R.
Lake Bangweolo
Lake Nyasa
Rovuma R.
Lujenda R.
Luangwa R.
Kafue R.
Broken Hill
Zumbo
Tete
Zambezi R.
Shire R.
L. Shirwa
Mozambique
Beira
Sabaki R.
Tana R.
CONGO FREE STATE
BRITISH EAST AFRICA
UGANDA PROTECTORATE
GERMAN EAST AFRICA
BRITISH CENTRAL AFRICA
PORTUGUESE EAST AFRICA

Lake KIVU.

	Feet.
Dr. Kohlschütter	4790

Lake ALBERT EDWARD.

	Feet.
Stuhlmann	3166
Lugard	3240
Stanley	3307
Moore	3106
Mean	3205

Lake ALBERT.

	Feet.	
Baker	2070	computed by Dunkin.
Stuhlmann	2231	
Lugard	2150	
Stanley	2140	5 observations.
Moore	2100	
Mean	2138	

Lake NAIVASHA.

	Feet.	
Macdonald	6350	computed by Ravenstein.
Jackson	6302	
Scott-Elliot	6826	
Mean	6493	

APPENDIX II.

LIST OF TRIGONOMETRICAL HEIGHTS AND APPROXIMATE POSITIONS.

	Latitude.	Longitude.	Trigono-metrical height.	Dr. Kohl-schütter's barometric height.	Mean of travellers' barom. and hyps. heights.
	° ′ ″	° ′ ″	Feet.	Feet.	Feet.
Mt. KILIMANJARO—					
Kibo	3 4 30 S.	37 21 0 E.	19,321 ± 6	—	19,718
Kimawenzi ...	3 5 40 S.	37 27 20 E.	16,892 ± 4	—	17,569
Kenya	0 9 0 S.	37 18 30 E.	17,007 ± 30	—	17,200 (Mackin-
RUWENZORI, Kanyangungwe	0 23 0 N.	29 52 20 E.	16,619 ± 10	—	—
Meru	3 14 30 S.	36 44 50 E.	14,955 ± 30	—	15,059 (Uhlig)
Mount MFUMBIRO—					
Karissimbi ...	1 30 20 S.	29 27 20 E.	14,683	—	—
Mikeno	1 27 50 S.	29 25 20 E.	14,385	—	—
Muhavura ...	1 23 0 S.	29 40 30 E.	13,562 ± 8	—	—
Sabyino	1 22 20 S.	29 35 30 E.	11,881	—	—
Elgon	1 5 50 N.	34 34 10 E.	14,152 ± 30	—	14,094 (Jackson
Sattima	0 18 40 S.	36 37 30 E.	13,214 ± 30	—	—
Kinangop	0 37 40 S.	36 42 20 E.	12,743 ± 30	—	—

	Latitude.	Longitude.	Trigonometrical height.	Dr. Kohlschutter's barometric height.	Mean of travellers' barom. and hyps. heights.
	° ′ ″	° ′ ″	Feet.	Feet.	Feet.
Lake Victoria ...	—	—	3,720 ± 8	3,724	3,840
" Tanganyika ...	—	—	2,624 ± 13	2,566	2,623
" Nyasa ...	—	—	1,645 ± 18	1,565	1,599
" Albert	(deduced height	with barometric difference)	1937		2,188
" Albert Edward	—	—	3,004 ± 7	—	3,205
" Kivu	—	—	4,829 ± 10	4,790	—
" Natron ...	—	—	1,996	—	2,132 (Fischer)
" Magadi ...	—	—	2,050 + 15	—	—
" Jipé	—	—	2,333 + 6	—	—
" Naivasha ...	—	—	6,135 ± 30	—	6,493 (Macdonald)
" Nakuru ...	—	—	5,668	—	5,980

NOTE.—The heights in the trigonometrical column are based on the mean sea level at Mombasa, carried to Lake Victoria by Uganda Railway levels. Lake Victoria is connected to Lakes Albert Edward and Tanganyika by a continuous triangulation. Lakes Tanganyika and Nyasa are connected by two independent triangulations.

Dr. Kohlschütter's heights were computed from recent observations made by reliable observers with the best instruments, and have been computed by his method.

Since this paper was read, the barometric determinations of all the snow-capped summits of RUWENZORI and their relative positions have been published by the Duke of the Abruzzi. The alterations to the positions of the minor peaks (to which there was only one theodolite ray) from those given in the July number of the *Journal* last year, has necessitated small changes in their computed heights.

The list of corrected trigonometrical values, compared to the barometric values, is as follows:—

Name of peak.	Trigonometric value.	Barometric value.	Difference, trigonometric minus barometric.
	Feet.	Feet.	
Margherita	16,619	16,814	−195
Alexandra	16,543	16,749	−206
King Edward	15,748	15,987	−239
Victor Emmanuel	15,846	16,079	−233
Umberto	15,554	15,797	−243
Yolanda	15,258	15,646	−388

The differences are very even; the discrepancy between the 195 and the 230-feet differences is due to the fact that the trigonometric height for the two topmost summits is the mean of observations from seven different stations, while the heights of the remaining four points depend on observations from one and the same station. The determinations for the topmost peaks from that station showed differences of 230 feet also. The Duke of the Abruzzi very kindly communicated to me his values quoted here, and remarked at the same time that the value he gave for Yolanda peak was less reliable, as it had been referred to an independent and less accurately determined barometric base station.

This perhaps accounts for a difference so divergent from the rest.

After the paper, the following discussion took place:—

Mr. DOUGLAS FRESHFIELD: I have some information from Uganda that may be fresh to the Fellows here. But, in the first place, I would say the remarks made by the reader of the paper are satisfactory to an amateur observer. It has always seemed to me that although we do not get scientific accuracy in our measurements of heights, we get approximate results which are useful for comparative purposes, and that often long before a Government Survey Triangulation finally settles everything. I hope we shall encourage travellers to go on using whatever instruments they have, and can manage. When the results are put together, they are often valuable.

With regard to Ruwenzori, I have just come across a record of the results of Dr. David's exploration on the western side. It appears in the *Journal* of the Italian Geographical Society, vol. 7, pt. 4. Dr. David states that Ruwenzori, or Runzoría, is a local name, and that he heard it used constantly. He goes on to say that the range is known as Kokora on the Semliki side. He rather qualifies this statement afterwards by telling us that Kokora is the name of a district. It is consonant with what we find elsewhere, that the mountain should not be distinguished by a name separate from that of the region in which it rises. Dr. David gives as the height of the lower tongues of the glacier 13,100 feet, the snow-level as 14,600 feet, and he believes himself to have reached 16,600 feet. But as he also says he was 1400 feet below the summit, which is now shown to be not more than 16,800 feet, it is quite clear that this is an error. Dr. David describes the view he had from the point he reached. He was able not only to see Lake Albert Edward, but also the volcanoes further to the south. I can believe in that wonderfully long view, because after a storm, we saw from the shores of the lake quite clearly the Mfumbiro peaks. The people living in the plains say that when there is fine weather on the mountain, they have thick haze over the plains; consequently, when the Duke of the Abruzzi was on the mountain, he was never able to see the plains or Lake Albert Edward from any of the peaks he ascended. Dr. David confirms or rather anticipates what the duke says—that there are many separate little *massifs* or groups, each with several peaks. I have another recent letter, which only reached me yesterday, from Dr. Wollaston, who has been travelling for the British Museum in these quarters, dated, from Lake Albert Edward, October 18. He gives an interesting description of the doings of the Belgian party that is travelling in that region, and which, we are glad to learn, is to be joined shortly by an official British Survey Expedition.

Sir GEORGE TAUBMAN GOLDIE: I did not intend to speak, but I wish to say a few words on Mr. Freshfield's closing remarks. I had a good deal to do with the system of marking boundary-lines in Africa, and, after a little experience, I steadily favoured the use of geodetic lines.

The system of using the frontiers of small states and tribes had led to endless complications and to a good deal of international trickery and friction; as whole districts which had always been regarded as subject to some central potentate were not only asserted to be independent, but were incited by colonizing powers to declare themselves independent. This more than once led us to the verge of a European war. The use of geodetic lines as frontiers had many minor disadvantages, but nothing comparable to those of the earlier system.

Major HILLS: I do not know that I have anything very special to say about the paper, except to express my interest in it. I think perhaps the discussion, in entering upon the boundary question, has gone a little bit off the main point of the paper, so that I will not follow in that direction. But with regard to these level results, I should like to state my appreciation of the work that Captain Behrens has

done in bringing all this material together in an easily accessible form. I think it is most valuable, and just the sort of work which I understand this committee exists for. I have no particular criticism to offer on the actual figures. Of course, as we look at the results now, we see the first attempts of explorers were often very wide of the mark; and while we fully recognize, as Mr. Freshfield says, that even approximate results are better than none, we can only be glad now that they have been replaced by comparatively accurate and reliable data. An interesting question connected with the subject of this discussion is that of the possible change of levels in these African lakes. In the future, we may assume it will be a very important point to decide as to whether the lake-beds are sinking in level or rising, and it is therefore imperative to get true levels fixed as soon as possible.

Mr. Freshfield: There are no signs of actual sinking on the shores of the lake.

Mr. George Wilson: I have listened with great interest to this discussion. May I be allowed to occupy just a few moments with reading notes which happen to be just by me at the moment? There seems to be a doubt as to the influence which mainly conduces to the rise and fall of levels on the Victoria Nyanza. The notes are by an officer in the Uganda Scientific Department, and are pertinent to this subject. They are: "The annual rise and fall of the lake, *due to rainfall*, is a matter of about 18 inches. The maximum height obtains during the months of April, May, and June, and the minimum during October and November. The maximum height during the current year was 18 inches above that of any previous year of which records are obtainable. The rainfall was also greater during the earlier part of this year."

In presenting these observations, I may perhaps add that during twelve years' experiences in the vicinity of the Victoria Nyanza I have always remarked that the rise in level has been coincident with rainfall, and the reduction with drought. The notes just read are based on records, and are confirmatory of this view.

Commander Whitehouse: I have been asked to say something about the level of the Victoria Nyanza. My own work is fully adjusted to the railway level of 3726, all my soundings being referred to that datum. I conclude a great deal of care was taken when the level was taken across the lake to the westward. The level of the lake alters a good deal; the greatest range now registered on the Port Florence gauge is 5 feet 1 inch, and, as far as I can tell, it may be 6 feet 7 inches, which is a different state of affairs to that quoted in the paper up to the date given. I have pointed this out with reference to the dock at Port Florence. I have often been told that the level at Port Florence cannot be referred to water-marks outside the Kavirondo gulf in the more open part of the lake; but I do not see why, it being all one sheet of water. I have also pointed out to Sir William Garstin the range likely to be registered, for his information on the Nile waterway. From watermarks I found at Mohuru point on the east coast in 1902, and others found later at Mwanza on the south coast of the lake, it appears that the level may rise on the Port Florence gauge to +5 feet. This information was obtained by adding the height of these marks above water to the average reading of the Port Florence gauge at the same time. The action of the wind affects the lake-level everywhere, and more so at Port Florence. I have seen a difference of as much as 17 inches in one day there. A north-easterly squall drove the water 7 inches below the then usual level, and the south-west breeze in the afternoon raised it 10 inches above the usual mark. The same effect may be noticed in all non-tidal water. I have never found any currents on the lake, except those caused by winds. At Mbita, the narrow entrance to the Kavirondo gulf, I have watched sticks and cormorants floating east through it, and on a heavy squall coming up from the

south-east, I saw the current stop running while I was looking at it, and then begi to run through the channel to the west.

In Sir H. M. Stanley's photograph, taken in 1875, of the Ripon falls—a ver low point, part of it about 2 feet high—is shown just above the biggest fall. Th same point is shown in my photograph of the same spot in 1900. Apparentl therefore, there has been no permanent change in lake-level for over thirty year which is the longest period that can be referred to.

I cannot say much about alteration of level due to change of barometric pressur but I believe barometer-readings there do not vary very much. I set up a mercuri barometer once where storms occurred daily, and read it constantly, finding ve little difference before, during, or after the storm, which was a very heavy one.

The level is probably slightly affected in this way, but there is not the slight doubt that the principal daily change is caused by wind. When noting level, ther fore, the general average should be taken, and not the reading of any particular d

I have referred to morning readings only of Port Florence gauge; the level nearly always higher in the afternoons, when the south-west wind blows up t Kavirondo gulf.

Mr. H. J. Mackinder: I am sorry I could not be here in time for the paper. will therefore limit myself to one remark with regard to Kenya. The height giv against my name in the table at the end is above the mean of my observations, a considerably above the lowest. I think the lowest was about 17,200 feet. If remember rightly, also, the height obtained trigonometrically by Captain Smith was about 17,200 feet. I have not seen what are the reasons for somewhat lowering his number, or whether there has been some subsequent observation.

Mr. Freshfield: I should like to ask one question. At the north-eastern corner of Lake Albert Edward there is a channel which connects with a lake which lies under the eastern side of Ruwenzori. When we were there there was a river about 600 or 800 yards across, with a strong current flowing into Lake Albert Edward. Earlier travellers have written as if the water sometimes flowed the other way, from Albert Edward into the smaller lake. This apparent change of level may be accounted for by exceptional rains on the Ruwenzori range.

Sir Thomas Holdich: I have nothing to say except to point out that, so far as I know, from none of these mountain peaks have reciprocal observations been taken Observations have been taken from the plains to the peaks, and not from the peak to the plains; consequently, there can be no absolutely fixed determination o heights, and we must not be too certain, in talking of trigonometrical results, tha the values of heights so fixed are at all the same as the values of heights fixed alon a line of railway or on the lakes. Those we may well accept, as Captain Behren has told us, with a small probable error of some 2 or 3 feet. But as regards Ruwen zori, I think it is quite possible that we may find eventually that we may have t alter these trigonometrical figures considerably. There are various reasons. In th first place, there is always a little difficulty in determining the exact point wher the altitude terminates on a snow-covered peak, and also there may be a differenc of level from time to time in the snow itself, but the great chance of error certainl rises from the fact of our having no determining value for refraction. To instanc the highest mountain in the world, we know that it may eventually be proved tha the height of Mount Everest may have to be corrected to the extent of about 10 feet or so, and we know that if we take the second and third highest, we may fin that Kanchinjunga ranks second and K_2 third after possible corrections. Such deter- minations can only be finally made when the correction due to refraction is really finally determined. Consequently, I quite agree with what Mr. Douglas Freshfield said about geographical explorers sticking to their barometric observations, althoug

no one is more convinced than I am that barometric observations are generally untrustworthy. Still, they are better than nothing. At any rate, the figures which Mr. Mackinder and Mr. Freshfield have quoted are, I think, very comforting. They are probably not very far from the mean trigonometrical results. All I wish to point out is that we cannot always accept the heights given for great altitudes as quite on the same scientific basis as those of lower regions.

Major Hills: With reference to what Sir Thomas Holdich has said, I think it is quite clear that the probable error of a single triangular determination is smaller than that of the very best reciprocal barometer observations. In many cases the probability of getting reciprocal triangular observations is so very remote that it is not likely to occur for many years. By upholding barometric observations, you are deliberately taking a lower standard when you have a higher standard available.

Dr. H. R. Mill: I have nothing to say that can be of any importance on the question of the level of the lakes, beyond expressing the interest that I feel in the change of level produced by the wind. Changes produced by differences of barometric pressure may also be quite appreciable in such large sheets of water as the Central African lakes. They have been studied in detail with regard to the North American lakes, where I think the changes of level amount to something like a foot between one end of a great lake and the other when there is a great difference in the barometer. Wind, of course, banks up the water against one shore, and must necessarily reduce the level in other parts of the lake to a corresponding amount. With regard to barometric determinations of height, one can never impress too strongly the fact that heights so measured are only roughly approximate. There is a tendency on the part of some travellers to look upon determinations by the boiling-point as inherently better than determinations by a mercurial barometer; the worst of the uncertainty, however, applies equally to the hypsometer, which is simply a barometer of a different type. The great difficulty is that we do not yet know exactly how atmospheric pressure changes with altitude in different conditions of weather. In anticyclonic conditions the rate of change of pressure with height is probably somewhat different from that holding good during the passage of a depression. In fact, we know so little about the state of things in the upper strata of the air, that I should feel much happier if all barometric heights above levels of 2000 feet were only expressed to the nearest hundred feet. If this were done, the appearance of excessive accuracy in doubtful measurements would be avoided. The method of trigonometrical determination is essentially more accurate, and it is reasonable when that is employed to give the height to the nearest foot.

Mr. Lamplugh: As the change of lake-level has come under consideration, it may be worth saying a word from the geological standpoint. In a sheet of water of this size, there is always a possibility that there may be slight movements of the land in progress which may gradually tilt the bed of the lake, so that a rise or fall of the water-level at one end need not necessarily mean a corresponding change in every part of the lake. The Americans have found that their great lakes have been very slowly tilted in this way, so that the water-level has not remained permanent in relation to the land. In all discussions of the levels of large lakes, especially when, as in the present case, there appears to be a slight discrepancy in the evidence, this factor of the possible movement of the land should, at any rate, be kept in mind.

The Chairman (Major Close): Before asking Captain Behrens to reply to the remarks that have been made on his paper, I should like to say something about the hypsometer. I think it will be a great pity when it disappears—of course, it is bound to disappear. Absolute determinations of height are like absolute determinations of longitude—you never know the accuracy of your result. The determinations of Lake Nyasa vary between 1200 feet and 1900 feet. I quite agree that it is very

desirable these heights should not be put down as if they were accurate. I think they ought to be put down to the nearest hundred, as Dr. Mill suggested. A reference was made to the political side of the question, especially as regards th Congo-Uganda boundary. I think it is common property that a Boundary Com mission has been appointed, and will shortly leave the country—a mixed commissio —to survey that frontier. I will now ask Captain Behrens to reply.

Captain Behrens: The idea of this paper was to collect the hypsometer an barometer values together and see how they fitted in with heights determined b what is after all a reliable method, and more or less consistent. All the result have been carefully checked. Of course, the results do not pretend to geodeti accuracy; they are only good secondary determinations. It is a pity that th level of Lake Nyasa has not been determined somehow from the Indian ocea or the Zambezi river. I endeavoured to find out if it had been, and the result wa negative. I understand that the geodetic triangulation will soon be able to b connected up there, and then we may get a check on the result (1645) which th trigonometrical observations give. Of course, the probable errors quoted here— cannot make this too plain—are not probable errors in a strictly scientific sense; i would have involved far too much labour and too much time to work out exa probable errors, but they may be regarded as approximately correct within a foot o two—that is to say, within a foot or two of what they would have been had the been very carefully worked out from the observations. I do not mean to say the represent the true probable error, taking all sources of constant error into accoun Commander Whitehouse said something about whether we took the level accuratel on the west of the lake.

Commander Whitehouse: I did not hint you did not.

Captain Behrens: What I wanted to point out was this, that on that date w took the level of the lake on the west of the lake, as being that given by th reading of the lake gauge at Port Florence on the same day; it was so many inch above or below the zero mark, and we considered that the level from which w started. Of course, if the wind had been blowing, there was a small source of err there, but I allowed for that in my estimate of the probable errors.

Commander Whitehouse: I understood you left the level on one side and too it up on the other. What I said was, you ought not to take the Port Florence gaug for that sort of thing.

Captain Behrens: You mean on account of the wind?

Commander Whitehouse: Yes; if you take the monthly reading and strike general average, you cannot depend upon accuracy. You cannot go on to decimal of feet.

Captain Behrens: That I am coming to. I allowed something in the probabl error; I allowed a foot, taking the level across the lake in that way.

Commander Whitehouse: I put a mark at Karungo; that is the place where th gauge ought to be. I asked them to look after it, and they went and dug it up a a bell. But for the lake-level there ought to be a gauge not at Port Florence—c course, the Port Florence gauge is good enough for my work—but it ought to be o the open lake, where it is not affected by wind.

Captain Behrens: The reason we did not take the readings of the Entebb gauge is because there seems to be such confusion between the gauges, and w thought the best thing we could do was to stick to the Port Florence gauge. Th daily range seems to be a very constant quantity. In looking all these things up i the table published by Captain Lyons, the daily differences between a.m. and p.m readings seem to be fairly constant. It would be very interesting to see what th Duke of the Abruzzi makes for the height of Ruwenzori; I believe he has bee

extremely careful. He has found a differential height, which he fixed by barometer readings between the top of the mountain and Port Portal, by constant readings for a month between it and Entebbe, so that ought to be fairly accurate. Mr. Mackinder spoke about the height I quoted for Kenya. The height quoted in the *Journal*, it seemed to me, was a little uncertain, and I should be very interested if we could discuss the matter further. It did not seem to me to be quite clear. I took what seemed to represent your barometric height as apart from anything to do with Captain Smith's.

Mr. Mackinder: My measurements were four, and two were triangular from a base about 3000 feet up, which base was fixed hypsometrically. Therefore, those were really checks on the others, and they were all four ordinary hypsometrical measurements. So I thought it was perfectly justifiable to take an average of the four; two of them, the 13,000 feet, are barometric, and then the remainder trigonometric. I think that is more accurate than taking the top measurements.

Captain Behrens: I do not think I have merely taken the top measurements, but I have forgotten the details.

Mr. Mackinder: My impression is you will find it average some hundred odd feet lower. But the chief thing I am interested in is how you get the difference of Captain Smith's measurements. He made his measurement 17,200 feet trigonometrically. There may be a difference in his base, but I think his base was the railway.

Captain Behrens: We compared the height we got with a large number of Captain Smith's previous measurements, and they seemed all to require a pretty constant correction, which was then applied. They seemed to be consistently higher or lower than our points, so I applied that correction to the height he found for Kenya.

Mr. Mackinder: There was a general error, was there, with all his heights?

Captain Behrens: Yes. About that arm of Lake Albert Edward, I was in camp on the shore of it for about a month, and I do not think I ever noticed any current at all. I think it must be due to wind, much the same as it is in Lake Victoria; or it might have been due to Ruwenzori rains. I was there for a month in the dry weather, and there was certainly no current in it. I went up a long way in a canoe.

Mr. Freshfield: The magistrate wrote to me and said there were the most exceptionally heavy rains he had ever seen, so that might have filled up the upper lake; but it is a huge sheet of water.

Captain Behrens: Yes, it is a big sheet of water further north, and only very narrow where it joins the lake.

Mr. Freshfield: Yes; it is only a river for 10 or 12 miles.

Captain Behrens: About the coefficient of refraction. I did not mention it, although I think I mentioned it in some notes on the determination of the heights of Ruwenzori. The only check we had was when we measured the coefficient of refraction very carefully at the level of about 6000 feet. That was the best that could be done. I suppose it is a closer approximation than if we had taken a coefficient of refraction which corresponded with the value we used in the middle of the day for other points. The effect on the local attraction would also come in, but I do not expect this is nearly as much at the base of Ruwenzori as it is in the neighbourhood of the Himalayas. It would naturally affect the height of the summit.

So far as the observations themselves went, the range of the observations—there were seven—were very consistent within themselves, and the range was small. About giving the figures to decimal places of feet, it seems to me if you give any trigonometrical results it is desirable, if they are to be used to carry on further work, to preserve the last place. It does not mean to say accuracy to the last place

is claimed for the figures, but if any one is to carry the work on it is a pity they should lose even part of a foot, and if all the significant figures are given the work that is carried on from them must be by that small amount more accurate.

Sir THOMAS HOLDICH: I look on the determination of the height of Ruwenzori as important because it is the highest, and it will inevitably be the basis for the determination of many heights westward. It may be eventually carried on in another survey to the western coast.

Captain BEHRENS: The difficulty about using Ruwenzori as a sort of bench-mark is that one so very rarely sees it. I should be very sorry to have to go out there and take my initial height from the top of Ruwenzori. I was there for some months, and I never saw the mountain more than about eight times altogether, and that was only by jumping out of bed in my pyjamas and getting to the instrument as quickly as I could; by the time I had spent five minutes at the instrument it had usually disappeared. With reference to the possible movement of land and the tilting of the lake-bed, is it not a fact that if one had a large number of gauges on the lake this would be detected? I think that is all I have to say.

Mr. WILSON: May I just say I have a note in connection with the rise and fall of the lake which might be useful. It is very brief. The actual rise and fall of the lake due to the rainfall is a matter of about 18 inches. The maximum height obtains as a rule during the months of April, May, and June, which are the rainy months, and the minimum during October and November. The maximum height during the present year was 15 inches higher than in any previous year for which results are obtained. The rainfall also was greater, so that the maximum height has always been coincident with the maximum rainfall. I do not know if that is understood, but I happened to have the note. In 1894, which would be several years prior to the period, it was 18 inches below that, so that during twelve years the lake has varied 14·6.

The CHAIRMAN: I will ask you to pass a hearty vote of thanks to Captain Behrens for his very interesting paper, which I know must have given him a great deal of trouble to prepare, and I think it has conveyed some very interesting information.

THE CONQUEST OF RUWENZORI: A NOTE.

By DOUGLAS W. FRESHFIELD.

I VENTURE to submit, in the following brief note, the comments and reflections on H.R.H. the Duke of the Abruzzi's paper on "The Snows of the Nile," which I might have made at the meeting had there been any opportunity for a discussion.

I shall imitate the Duke of the Abruzzi in avoiding any lengthy argument as to the identification of Ruwenzori with Ptolemy's Mountains of the Moon. It is enough for me that its snows feed two of the Nile lakes. But I may point out the sort of rumours which two hundred years and more ago were recorded in Arab chronicles; for it is highly probable that stories of the same kind reached the Greek geographer, and were the ground of his long-disputed assertion that the lakes of the Nile are fed by eternal snows.

In A.D. 1686 an Arab compiler, quoted by Sir H. M. Stanley,* undertook to describe from earlier authorities the legendary snows at the Nile sources. I make here a few extracts from his compilation:—

* 'In Darkest Africa,' vol. 2, pp. 280–281.

"Others say that the Nile flows from snowy mountains, and they are the mountains called Kaf."

". . . This chain has peaks rising up into the air, and other peaks lower. Some have said that certain people have reached these mountains and ascended them, and looked over to the other side, where they saw a sea with troubled waters, dark as night. . . . Some say that people have ascended the mountain, and one of them began to laugh and clap his hands and threw himself down on the further side of the mountain. The others were afraid of being seized with the same fit, and so came back. It is said that those who saw it saw bright snows, like white silver, glistening with light. Whoever looked at them became attracted, and stuck to them until he died, and this science is called human magnetism" (*sic*).

"It is said that a certain king sent an expedition to discover the Nile sources, and it reached copper mountains, and when the sun rose the rays reflected were so strong that the men were burnt. Others say that these people arrived at bright mountains like crystal, and when the rays of the sun were reflected they burnt them."

Here we have a curious combination—references to snowburns, mountain sickness, and, one might almost add, to the *amor scandendi*. I may mention that the natives of Toro use and sell the fragments of crystal found in the range as charms, and that those who live far from the mountain still believe the shining summits they see from time to time among the clouds to be composed of the same substance.

It is, surely, rather a large claim on our credulity to insist that these graphic details were all pure inventions of the happiest kind and had no connection with the corresponding local facts.

I turn from legend to discovery. The Duke of the Abruzzi's map supplies us, for the first time, with a clear picture of the upper region. Its characteristic is the absence of any continuous snowy chain, and the number of relatively small glacier-clad blocks or *massifs* separated by gaps 2000 feet below them. In the upper region no extensive *névés* are found; the gneiss summits carry frozen caps, the substance of which heat and consequent infiltration rapidly turn into ice. A conspicuous and peculiar feature are the cornices supported by icicles which have grown into ice columns, till, looked at from below, they recall in form the cliffs of Staffa. There is little or no permanent snow apart from glaciers, but here and there an avalanche lies unmelted among the exuberant vegetation. As in most regions of similar geological structure (the Maritime Alps, the Adamello group) rock basins abound, and not a few have escaped from being choked by alluvial deposits, and contain still tarns, which reflect the snows and waterfalls of the highest peaks in a framework of giant Senecios and white Everlastings. Of these tarns the Bujuku lake appears to be the most fascinating.

With his excellent Cormayeur guides and porters the Duke made a thorough sweep of the snows. Fourteen summits were scaled, and those that remain are of secondary importance. The finest expedition left is probably the glacier pass between the Alexandra and Moebius peaks, the western side of which may be studied in the excellent illustration opposite p. 288 in Dr. Stuhlmann's book, 'Mit Emin Pasha ins Herz von Afrika.' The illustration on p. 296 of the same work can, by the help of Signor Sella's photographs, be recognized as King Edward's Peak. The westernmost summit of Mount Stanley, conspicuous from Butiti, is also unnamed and unclimbed.

In one respect the Duke was unlucky. He never, when on the highest summits, enjoyed a view of the great lakes or a clear horizon. Now, Ruwenzori can be seen in intervals in the rains as far as Mbarara, some 70 miles to the east as the crow

flies. The explanation may be—at any rate, this explanation is suggested by the tales of previous travellers—that during the dry season on the mountain haze obscures the lowlands. Most of those who have approached Lake Albert Edward speak of its fogs. When we passed it the air between the storms was gloriously clear, except about Ruwenzori, and we saw distinctly the Sfumbiro volcanoes. Dr. David, the Belgian traveller, tells us that he saw them and the lake from a point 1400 feet below the top of Ruwenzori, on its western slope.

With regard to the traces of ancient glacial action, Dr. Roccati, the geologist who accompanied the Duke, confirms and enlarges my observations with the authority of an expert. He sees distinct traces of moraines near Bihunga and on the steep slope at the mouth of the upper Mobuku valley, 5 miles from and 6500 feet below the existing glacier. With regard to the blocks scattered still lower in the level valley at Ibanda, he, like me, hesitates to express a definite opinion as to their mode of transport. I shall be interested to ascertain if he is disposed to entertain my hypothesis of a flood caused by the bursting of a subglacial reservoir.

As regards the practical uses Ruwenzori may prove to have for Uganda, it will be discovered, I imagine, that it is not in the valleys below the snows, but on the broad upland slopes at the northern end of the chain, that sites for European cultivation and for a sanatorium may be found in the future.

MOUNT STANLEY AND MOUNT SPEKE FROM BUTITI.

I would ask map-makers to bear in mind two physical facts often misrepresented. The Kafuru straits, connecting Lakes Albert Edward and Ruisamba, are only 700 to 800 yards wide and many miles long. They are more accurately shown in Sir H. Johnston's maps than by any other cartographer. Next, the Ruwenzori range ends to the north in a bold spur thrown into the Semliki valley, and there is a deep recess between this and the escarpment which runs north from the neighbourhood of Fort Portal to the southern end of Lake Albert.

With respect to the main characteristics of the glaciers of the Nile, it will be seen that my own first impressions have been, as a whole, confirmed. The highest peaks reach very nearly 17,000 feet—the elevation Mumm and I first conjectured on the spot. I may note, parenthetically, that I did not (as has been quoted) assign to them 18,000 feet, but put the *possible limits* of their height as 16,500 and 18,000 feet, inclining myself towards the lower figure. I estimated the glacier region to be included in a circle 12 miles in diameter; on the Duke's map it is reduced to 10. As to the permanent snow-level, 14,400 feet, I am in exact accordance with the Duke. The snowy mass we saw from Butiti proves, as I wrote in May last, to be composed of the tops of the highest peaks (Mount Stanley) seen

over Duwoni (or Mount Baker). This summit is rightly known as "Johnston's Duwoni," since it is the peak he drew from Ibanda. But some confusion has arisen from the fact that, when at the head of the Mobuku valley, Sir H. Johnston thought the summits to the east of the icefall were identical with those he had seen from Ibanda (see Johnston's 'The Uganda Province,' vol. 1, pp. 158 and 187).

On the other hand, Dr. Wollaston's report led me into the erroneous belief that the highest peaks were not on the watershed. The Duke has cleared up and established the topography of the inmost portion of the group by his discovery of the importance of the long Bujuku valley. When we passed its opening mists and rain-storms hid the landscape; but it is strange that it should altogether have escaped the British Museum party, for whom it might have proved a happy hunting-ground during the weeks they spent at Bihunga. The Duke has also shown that all previous travellers were in error in regarding the crest at the head of the Mobuku glacier (Moore glacier) as part of the watershed.

In the foregoing remarks I have been greatly assisted by the superb panoramas and photographs presented to me by my former companion in the Himalaya, Signor Vittorio Sella. The perfect panorama from King Edward's peak (Kiyanja) is a masterpiece of mountain photography, which rivals his "Caucasus from Elbruz," or his "Kangchenjunga from the North-West."

It is not uncommon, even in unexpected quarters, to find it assumed that "a mountaineering party" is incapable of rendering any return to geography and science. Mountaineers may point, in Ruwenzori, to an instance where they have succeeded, after many experienced travellers, who were not mountaineers, had failed, in lifting the veil of centuries and giving the world accurate knowledge of a most interesting and fascinating region—the Snows of the Nile. The Duke of the Abruzzi and Signor Sella have done for the region above the snow-level what Sir H. Johnston had previously done for the lower zone of forests and flowers.

A NEW BRITISH ANTARCTIC EXPEDITION.

By E. H. SHACKLETON.

I AM at present organizing a new expedition to the South Polar Regions. My purpose is that this expedition should leave New Zealand at the end of January or beginning of February, 1908. The expedition will, unlike that of the *Discovery*, consist of a small shore party of nine to twelve men, who will winter at the winter quarters of the *Discovery*. The ship will either be a whaler, specially chartered or purchased, or a full-powered steamer, capable of doing 10 knots, which will not leave New Zealand until February, when the sea in the South is free of ice. On landing the party, the vessel will return to New Zealand, and the charter will be up until the following year. There will thus be no risk of the ship being frozen in, and there will be no responsibility to those at home.

The funds at present at our disposal admit of the following programme.

The shore party of nine or twelve men will winter with sufficient equipment to enable three separate parties to start out in the spring. One party will go east, and, if possible, cross the barrier to the new land known as King Edward the Seventh's Land, follow the coast-line there south, if the coast trends south, or north if north, returning when it is considered necessary to do so. The second party will proceed south over the same route as that of the southern sledge party of the *Discovery;* this party will keep from 15 to 20 miles from the coast, so as to avoid any rough ice. The third party will possibly proceed westward over the mountains, and, instead of crossing in a line due west, will strike towards the magnetic pole.

The main changes in equipment will be, that Siberian ponies will be taken for the sledge journeys both east and south, and also a specially designed motor-car for the southern journey. A North China or Siberian pony is capable of dragging 1800 lbs. on a food basis of 10 lbs. per day. A dog drags 100 lbs. at the outside, and requires over 2 lbs. of food a day. Therefore, one pony drags as much as eighteen dogs at less than one-third in weight of provision, and can travel comfortably 20 to 25 miles a day.

The motor will be of a special type, taking into consideration the temperatures to be encountered and the surface to be travelled over. I would propose to take three or four ponies on the southern journey, and the motor-car. As long as the car continued to remain satisfactory, it alone would be used to drag our equipment and provisions. If it broke down and could not be fixed up, then the ponies would take over the load.

I would propose travelling at the rate of 20 to 25 miles a day, and feel assured that, providing the motor does its work, we could reach with it a point beyond 82° 16′ S. I intend, every 100 miles, to drop a sledge-load of provision and equipment, so that, in the event of every means of traction breaking down except by men, we would only have 100 miles to go between each depôt on return. The geographical south pole is 731 miles from winter quarters, and allowing that we only go with the motor to 82° 16′, we would then practically be starting for the remaining 464 miles as fresh as if we were starting from the ship. What lies beyond 83° S. we cannot tell, but I am of opinion that we can follow the trend of the southern mountains for a very long way south, before they turn either east or west. Should they turn to the eastward, and we find it impossible to get over them with the ponies, we would pull the sledges ourselves up the nearest available glacier. If no way up the mountains is found, we would continue following them round to the eastward, until we found it necessary to return towards winter quarters. If, on the other hand, the mountains turned to the west, we would continue straight south, and, if the surface were favourable, would increase the distance between our depôts to 150 miles, to

admit of a more extended journey. On reaching the geographical pole, we should strike at an angle about north-west, and so pick up the mountains to the westward. When it became necessary to return, we would then strike due east, and begin picking up our last depôts.

I do not intend to sacrifice the scientific utility of the expedition to a mere record-breaking journey, but say frankly, all the same, that one of my great efforts will be to reach the southern geographical pole. I shall in no way neglect to continue the biological, meteorological, geological, and magnetic work of the *Discovery*. Should we have sufficient funds, we would land a small party of men at the nearest available point to the south magnetic pole. When the time came for sledging, they would move over the mountains towards the pole, taking careful observations the whole time, and if good fortune attends them and they reach the pole, they would survey the magnetic area as far as possible. During their winter stay in the vicinity of Mount Melbourne, the magnetic instruments would be running, and the meteorological observations would be taken at the same time as they would be taken in our winter quarters, so that a comparison could be made afterwards. If possible, in the winter quarters, where also magnetic observations will be taken, we would have a small launch in use for the remainder of the summer, in which the biologist could do marine dredging in a more continuous way than we were able to do on the *Discovery*. As regards geology, the wintering party by Mount Melbourne would have a new field to work on, and I would propose that careful observations and collections be made in all departments, the results of which could be worked out by those at home more qualified to do so than the field workers; and if the expedition proves a success, we intend to publish in as complete a manner as possible all the scientific results. By this means I would hope to have an expedition that will not only be successful in the field, but will make a mark in the scientific world on its return.

On the return of the vessel in February, 1909, the first party to be picked up would be that in the far south; the second party, at Mount Melbourne, would be picked up on the return. Should I only have a full-powered steamer of steel, it would not be possible for me to risk the approach to Mount Melbourne; but I hope through friends who are interested in this work to increase the scope of the expedition. Then, having a whaling vessel—which even now I may get—I propose, after picking up the party at Mount Melbourne, to proceed north of the Balleny islands, come down south again at the longitude where the *Discovery* turned north, and keep in as far south as possible to trace the north-western coast of Wilkes' Land, going as far west as possible before it is necessary to turn north. If we could settle the exact coastline of Wilkes' Land, it would be a great help to geography. By the southern and eastern sledge journey we may possibly solve the problem

of the great ice-barrier; by the journey along Wilkes' Land we may lay down a definite coast-line; by the charting of new mountains and discovery of new lands in the far south we aid geographical science; by the magnetic work we help not only the academic side of magnetic science, but we may help the mercantile community in the way of better variation charts.

As regards *personnel* this is not yet settled, but I hope that some of those with whom I was associated before will come again, so that their training and experience of from 1901–4 will be available. I would like to add that, if possible, during the winter, we should try and watch the breeding and nesting of the emperor penguins.

As regards equipment, which I have worked out, I can say but little now, and this is not the place for it; but such things as a cinematograph for showing the movements of the penguins, and a phonograph for recording their cries, will be amongst the things taken to give our countrymen at home a better knowledge of the natural history of the place.

THE KINGSTON (JAMAICA) EARTHQUAKE.

On June 7, 1692, the island of Jamaica was visited by an earthquake of great violence and extent. Throughout the island destruction was general, houses were overthrown, fissures opened in the ground, the mountains were scarred with landslips, and at Port Royal, then the capital of the island, a tract of 1000 acres was submerged beneath the sea to depths of 4 to 6 fathoms, while other parts underwent little or no change of level. How far this subsidence was due to the settlement of unconsolidated surface deposits is uncertain, but the earthquake was evidently of the same type as the Californian one of last year or the Alaskan of 1899; there may well have been movement along fault lines, like those described by Messrs. Tarr and Martin in this *Journal* of July last, and in this way a considerable subsidence of one part of the town may have taken place while the rest was but little affected in this respect. Be this as it may, the area available for building was so much reduced that a part of the population had to migrate and establish itself at Kingston, which became in time the capital of the island, and now, by the irony of fate, was itself destroyed by an earthquake on January 14, 1907.

Though it has attracted as much attention, and filled as much space in the daily papers as the Californian and Chilian earthquakes of last

year, the Kingston earthquake was of a very different character and order of magnitude. In the former case, the focus and the zone of destruction were measured by hundreds of miles; in the latter, the damage was practically confined to three parishes, according to the Governor's report, but these three parishes comprised the busiest and wealthiest districts of the capital, and in them destruction seems to have been almost complete, and far more thorough than in San Francisco or Valparaiso. The shock was, in fact, very similar in character to that which destroyed Casamicciola in 1883—that is to say, of great intensity but small extent; the Ischian earthquake was barely felt even at Naples, and the Jamaican one does not seem to have been generally felt in the island. It is possible that earthquakes of this type are more common than is thought; as a rule, they would escape notice owing to their small extent, and it is only when a town happens to lie within the limited area of great evidence that they attract general attention.

A question which has arisen in connection with the repeated reports of destructive earthquakes during the last year or so, is whether there is in reality any increased instability of the Earth. This supposition has found common acceptance of late, and been strengthened by the paper lately read to the Royal Society of Edinburgh by Lord Kelvin, in which he pointed out that, on the hypothesis of a solid, heated, and cooling Earth, volcanic activity should become gradually less, and seismic action greater, as cooling progressed; but it must be borne in mind that the change contemplated by this hypothesis must be extremely slow, and it is hardly probable that any noticeable change could have taken place within the historic period, certainly not within the memory of living man. The supposition that earthquakes are increasing in violence finds no support, therefore, in theory, and still less in actual fact when this is carefully examined.

A score of years ago, or less, when the possibility of knowledge was confined to such earthquakes as could be felt, the occurrence of four destructive earthquakes within a twelvemonth might have led to false conclusions, but, with the advent of the new seismology, and the setting up of numerous instruments capable of recording distant earthquakes, we now know that many earthquakes, as severe as any of the recent American ones, occur each year, but escape common notice through their origin being under the sea, or in sparsely populated or uncivilized parts of the Earth. For some years past Prof. Milne has recorded the tale of these great earthquakes each year in the Reports of the British Association, and from these we find that the number of great earthquakes was 110 in 1899, 117 in 1900–01, 69 in 1902, 64 in 1903, 35 in 1904, 59 in 1905, or an average of 66 great earthquakes a year.

From these figures it will be seen how insignificant is the total of the earthquakes which have made such an impression on us as compared

with those which pass unnoticed. The figures for 1906 are not yet available, it is not improbable that the total will be above the average, or it may be less, but no conclusion can be drawn from the fact that a small proportion of the great earthquakes of last year happened to find a large town within the area of their destructive powers. So far as facts go, there is no reason for supposing that any particular town or city is either more or less liable to destruction by earthquakes than it has been in the past.

R. D. O.

REVIEWS.

EUROPE.

Mackinder's Britain.

'Britain and the British Seas.' By H. J. Mackinder. Second edition. Oxford: Clarendon Press. 1907. *Price 7s. 6d. net.*

Since its first appearance five years ago, this work has held the field as the only serious attempt yet made to picture the physical conditions of the British Isles in such a way as to bring out clearly the influence which those conditions have had on the human societies dwelling in them. Those, even, who may have been inclined to question the validity of some of the theories advanced, or the deductions made from them, have freely recognized the force with which the author's views were presented, and the unity of purpose and grasp of principles displayed in the whole treatment of the subject. The appreciation which has been accorded to the book is shown by the comparatively short time within which a new edition has been called for. During that space nothing has occurred in the field of geography calling for any radical change of standpoint, and the work is to all intents and purposes the same in its second as in its first edition, while at the same time it has been subjected to a careful revision in matters of detail. Of the minor alterations, some have been made in deference to criticisms and suggestions by reviewers and others. Thus the term "Cheshire gap," to which exception was taken in the review which appeared in the *Journal*, has been replaced by "Midland gate"—the term adopted by the R.G.S. Committee on the nomenclature of the physical features of England. On various other points the author has naturally shown himself unconvinced, and in particular has adhered to the general arrangement of the chapters, which some had criticized as not strictly logical. The additions in the present edition consist in great part of notes at the end of the chapters, calling attention to the results of research, published since the first appearance of the book, or supplying further elucidation of special points. Some new matter is, however, incorporated in the text of the chapters, especially those dealing with the evolution of the river systems, and with ethnographical and historical geography, on which subjects research has perhaps been more active than on others. The fisheries of the British seas also receive fuller treatment. Students may thus feel assured that the book is in every way abreast of the time,

and it will no doubt long remain an indispensable source of inspiration to all who desire to work out the relations between man and his environment within these islands.

ASIA.

The Malay Peninsula.

'British Malaya: An Account of the Origin and Progress of British Influence in Malaya.' By Sir Frank Swettenham, K.C.M.G., late Governor of the Straits Colony, etc. London: John Lane, The Bodley Head.

The author of this instructive book, in his preface, remarks that though we have no special school for such training, yet Englishmen excel as administrators. He rightly connects this aptitude with our geographical position, which necessitates well-trained sailors, who, from early life, are accustomed to face the unexpected with equanimity. As he says, "it would be difficult to devise any responsibility, however onerous and unattractive, which a midshipman would not at once undertake, though it had no concern with sea or ship. . . . One may, however, question whether any one but a midshipman would have willingly embarked upon a voyage to discover the means of introducing order into the Malay States when that task was thrust upon the British Government in 1874."

The volume tells how this was done, and the story is as creditable to all concerned as it is gratifying to our national pride. For, to put it mildly, without encouragement from officials at home, and in spite of warning that if the limits of masterly inactivity were exceeded, the local officers would have to take all risk and bear all blame, yet they preferred responsibility to impotence. They boldly took the initiative in reform, and, when distrust was allayed, were completely supported by the Malays.

There are many States in the peninsula: some in the Straits Settlements (a crown colony), others under Siam, and those known as the Federated Malay States. The last group supplies the chief interest of Sir Frank Swettenham's book, whence the steps from chaos to prosperity may be traced. Not least among the factors of success were the Chinese, who worked the tin-mines. French and other European companies were formed for the purpose; "but it was the Chinese who began the work, who have continued it ever since, and whose efforts have succeeded in producing more than half of the world's tin supply. Their energy and enterprise have made the Malay States what they are to-day, and it would be impossible to overstate the obligation which the Malay Government and people are under to these hard-working, capable, and law-abiding aliens. . . . But the Chinese were not only miners; . . . as contractors, they constructed nearly all the Government buildings, most of the roads and bridges, railways, and waterworks. They brought all the capital into the country when Europeans feared to take the risk; they were the traders and shopkeepers; . . . and it is their work, the taxation of the luxuries they consume and of the pleasures they enjoy, which has provided something like nine-tenths of the revenue." This tribute to the race in Malaya may with advantage be considered, and its lesson be applied elsewhere.

The funds obtained from mining operations were used to develop the country; roads, railways, irrigation, and jungle clearance were proceeded with, and cultivation followed. Para rubber was planted on a considerable scale, with results so profitable as to encourage young men with a taste for open-air life and adventure to seek their fortune in these States. The book is attractively got up, and the illustrations deserve special praise.

W. B.

The Climatological Atlas of India.

'Climatological Atlas of India.' Published by the authority of the Government of India, under the authority of Sir John Eliot, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India and Director-General of Indian Observatories, Issued by the Indian Meteorological Department, 1906, . . . through Messrs. John Bartholomew & Co., Edinburgh.

The Indian Meteorological Service is the largest and most complete system of the kind in the tropics, and its history, as outlined in the Introduction to the Atlas under review, is a record of steady improvement and progress. The history is divided into three periods: that previous to 1864 or 1865, when such observations as were made were local, and arranged upon no system; that between 1865 and 1875, when the work was organized on a provincial basis, and was still lacking in completeness and comparability; and, finally, that from 1875 to date, when the organization was imperial and directed from a central office. It was only in the last period that the observations, as a whole, reached such a general level of uniformity and accuracy as could warrant the detailed treatment necessary to turn them to account in establishing the climatology of India.

The last quarter of the nineteenth century is the period for which the various elements of climate have been worked up, and this work also falls into three parts: the elaboration of the figures of actual observations so as to yield numerical means and extremes, the results of which have been published in various volumes of the Indian Meteorological Memoirs since 1901; the Atlas now before us, giving cartographical expression to the data formerly published in Tables, and a 'Handbook of the Meteorology of India' which is promised, and in which the bearings of the whole work will be authoritatively set forth. Meanwhile, the Atlas is prefaced by a certain amount of letterpress, though not enough to make it independent of the memoirs of the past or the handbook of the future. While the meteorologist must of necessity refer back for much essential information, and summon his patience to wait for some desirable generalizations, the geographer, at least, may accept this Atlas as a single and substantial gain to his knowledge, and proceed in its light to rearrange his ideas of Indian climate.

The organization which made the Atlas possible deserves to be referred to. The commission appointed to inquire into the Orissa famine of 1866, recommended that Prof. Tyndall should be invited to come to India "and develop meteorological inquiry." This, apparently, was not done. In 1871, after considering memoranda from Mr. H. F. Blanford and Sir Richard Strachey, the Indian Government consulted the Council of the Meteorological Office in London,* which suggested a scheme for reorganization. The Indian Government accepted this scheme, and appointed Mr. H. F. Blanford as imperial reporter, entrusting to him the carrying out of the new system. Mr. Blanford continued to direct the work, extending the system of observations to the larger native states and improving details; but the record of the work of the department becomes more impersonal as it proceeds, and the date at which Sir John Eliot succeeded Mr. Blanford is not mentioned. Sir John had, however, been meteorological reporter for the province of Bengal since 1874, so that his personal labours in a responsible position in India extended over

* Presumably the body consulted was the Meteorological Committee of the Royal Society, which was responsible for the Meteorological Office from 1867 to 1877.

the whole period dealt with in the Atlas, and there is certainly no one else with such a grasp of the whole vast subject as he.

With the meteorological aspects of the work we have at present no concern. The question of the trustworthiness of native observers, the problem of the proper exposure of instruments, the methods of reduction and correction are all considered and settled in the volumes of the Indian Meteorological Memoirs, and we have only to see how these data, which are unquestionably the best that could be had, have been brought together in the form of maps, and what these maps teach regarding the climate of India.

The Atlas, which is produced by Messrs. John Bartholomew & Co., of Edinburgh, is similar in size, and in the execution of the 120 plates of maps, to the volume on Meteorology in Bartholomew's great 'Physical Atlas,' except that the binding is in plain cloth, which will doubtless prove more enduring than leather, and the paper on which the letterpress is printed is too thin for the great size of the page.

A series of general maps serves as an introduction to the special plates dealing with climatology. First come two double-page maps of the Indian Empire on the scale of 1 : 10,000,000; the first showing the configuration by a striking series of graduated tints which bring out the contrast of the Central Asian plateau, over 10,000 feet in elevation with the plains and hills of India; the second giving the larger features of the complex political geography. The physical geography of India is a fact of such supreme importance that it is very properly carried through all the climatological maps by means of contour-lines and faint black tinting, quite unobtrusive, and in no way spoiling the effect of the special colouring, but quite distinctly there when looked for. As is well known, the figures of atmospheric pressure and temperature are usually charted after reduction to their calculated values at sea-level; but the uncertainty of the correction at great heights is so considerable that Sir John Eliot has wisely refrained from utilizing, in this way, any data derived from stations at a higher elevation than 3000 feet above the sea. The practical result of this is to limit the scope of the maps to India proper, and to stop all climatological colouring on the slopes of the Himalaya short of the great Tibetan plateau. We are glad to note that for the purpose of this Atlas Ceylon is included, as it should be, in representing the distribution of atmospheric phenomena. Two plates are occupied with four maps showing subdivisions of India adopted for various statistical purposes, and then follow two double-page charts of the Indian ocean, illustrating the general distribution of pressure and the direction of the winds at two opposite seasons—January and July. These are most interesting and suggestive, for they show the climatological solidarity of the British Empire around the Indian ocean, illustrating the interdependence of the climate of India with the climates of Singapore, Hongkong, Borneo, New Guinea, and Australia on the one side, and those of Aden, Somaliland, British East Africa, Zanzibar, Mauritius, and South Africa on the other. The great annual overturning of the atmosphere which drives the air in January—the northern winter and the southern summer—from Asia southward over India, across the equator towards Africa and Australia, and draws back the air in July—the northern summer and the southern winter—from Australia and Africa, across the equator to India, really dominates the climate, not of India only, but of all the Indian ocean, and these striking plates exhibit the surge of the air in a really impressive way.

After the introductory maps, which deal with arrangement and general principles, come masses of orderly detail set out more fully than for any other country. As a rule, thirteen one-page plates are devoted to each special subject, representing the distribution for each month and for the year as a whole. The page is usually

shared by three maps, the natural scales of which are unfortunately not given; but one representing the condition at 8 a.m. is on the scale of about 225 miles to 1 inch; the other two, representing in less detail the conditions at 10 a.m. and 4 p.m., are on the scale of about 450 miles to 1 inch. The charting of mean meteorological conditions for two hours of the day, showing the full effect of the diurnal range, is quite new, and places this atlas above every other work of the kind. The number of stations yielding records and the duration of the periods from which "normals" are calculated differs somewhat for the different elements; but in every case the number of stations is relatively so small that the lines of equal value which are drawn must be viewed as only roughly approximate.

The first element dealt with is barometric pressure and wind, and while the large map enables one to follow the changes from month to month in detail, the two smaller maps remind one of the large diurnal range which is constantly at work altering the force of the wind at every hour of the day and night. Thus it appears that the average pressure over India varies as much between 8 a.m. and 4 p.m. every day in April (to take an example at random) as it does at 8 a.m. in a whole month during the gradual annual change. The next series of thirteen maps shows the average daily pressure for each month on the larger scale, and the diurnal range expressed in two different ways on the two smaller maps. Tropical meteorology differs from that of temperate countries in nothing so much as in the regularity and extent of the regular diurnal range of pressure between morning and afternoon, and this series of maps gives much new matter for study.

Temperature maps follow, the first thirteen showing the mean temperature of the day, the mean maximum and the mean minimum of each month; bringing out with quite startling vividness how the area of greatest warmth moves north-westward across India as the season advances, until the Punjab and the extreme north-west which were the coolest part of the peninsula in January, have become the hottest in June; showing, too, how in India the south or most nearly equatorial portion is the coolest part of the country in the hottest months, the influence of height above sea-level being allowed for. Thirteen maps show, in the first place, the distribution of diurnal range of temperature for every month, and, in addition, the absolute maximum and absolute minimum temperatures for the month. The range is remarkable; thus in January there are maxima exceeding 97°·5 in South India, and minima falling short of 25° in the north-west, whereas in June and July there are maxima exceeding 125° in the north-west and minima below 65° in the south.

The next set of thirteen plates deals with relative humidity, a condition which is not so frequently charted as its importance deserves. The distribution is always such that the highest percentage is found in the north-east and round the coast, the lowest in the interior and towards the north-west, but the centre of minimum relative humidity moves farther into the north-west angle of the country as summer advances. The range in relative humidity between 9 a.m. and 4 p.m. is very striking, being dependent, of course, on the great range of temperature. Unfortunately, the readings of the wet-bulb thermometer, on which the humidity observations depend, are the least satisfactory of the elements of climate observed, and there is less certainty about the results than in the case of pressure and temperature. A second series of thirteen plates deals with the absolute humidity or total amount of water-vapour present in the atmosphere irrespective of the temperature or the probability of condensation. While the relative humidity is the more important condition in its relation to practical matters of health and agriculture, the absolute humidity has a special value in meteorological discussions, and its variations from month to month show a close relation to the seasonal changes of wind.

A beautiful series of thirteen plates shows the proportion of the sky covered with cloud, on the average of the day, at 8 a.m. and at 4 p.m. The colouring shows small amounts of cloud in tints of blue, large amounts in shades of brown, forming in this way almost a picture of the state of the sky. The resemblance with the relative humidity maps is, of course, very close, although the cloud-maps represent the approach to saturation in a much higher stratum of the atmosphere than that dealt with by the wet-bulb thermometer. In the cold weather, from November to February, there are two areas of moderate cloud, one on the slopes of the Himalayas, the other in southern Madras; the country between the two is practically cloudless. In the hot weather the regions on which a strong sea-wind blows are heavily clouded, the regions most affected shifting with the seasonal changes of wind, but the north-west corner of India remains with the minimum amount of cloud all the year through.

The section devoted to rainfall maps is particularly interesting, for it is here that the influence of geographical conditions upon climate are most clearly marked. The effect of height above sea-level on atmospheric pressure and on temperature is carefully eliminated before the figures are placed on the map, but rainfall is charted as it falls. The general distribution of rain in India, depending as it does on configuration and on seasonal winds (or currents, as the Indian Meteorological Department prefers to call moving air as well as moving water *), is familiar in its broad features. The larger map for each month represents the normal rainfall in inches, the smaller maps give the number of rainy days (in India this means days with one-tenth of an inch or more) and the tracks of storm-centres crossing the country; and half a dozen additional plates present the rainfall of the various seasons. By taking account of the rainfall, it is possible to divide each of the fundamental divisions of the Indian year (those in which the nòrth-east and the south-west monsoons respectively occur) into two parts. During the first half of the dry season, from December to February, in the cold weather rain occurs chiefly during the passage of shallow depressions across the north of India, bringing heavy snow on the northern mountains. The second part of the dry season or hot weather (March and April) has only light irregular rains due to local thunderstorms, but in Assam these rains are very important to tea-growers. From May or June to September the south-west monsoon brings a general rainfall over the whole of India except South-Eastern Madras and the extreme north-west. The remaining months of October and December have heavy rains round the Bay of Bengal as the monsoon retreats, while the greater part of India is dry.

The scale of the annual map of normal rainfall is too small to do more than indicate the broad general dependence of rainfall on configuration and wind direction, bringing out the general wetness of the coasts, especially the west coasts, and the general dryness of the interior, especially in three large areas, viz. the Indus valley in the north-west, the upper valley of the Krishna behind the Western Ghats in southern India, and the middle valley of the Irawadi in Burma. The detailed relationship between rainfall and configuration is not advanced by this work. We must confess, indeed, that the treatment of rainfall as a whole is a little disappointing. The omission of stations above 3000 feet deprives the map of much of its character, and in this department of climatology where geographical principles are

* In the text Sir John Eliot refers to "the great oceanic current of the south-west monsoon," meaning thereby the wind that blows over the land, not the water that flows in the sea. To use a technical term of oceanography without explanation or definition to describe an allied but totally different phenomenon in meteorology seems to us a mistake.

most closely concerned we miss the firm grasp which might have brought the data into a completer shape than they at present show.

With reference to the great advance now being made in our knowledge of the upper regions of the atmosphere, attention may be called to a series of small maps showing the pressure of the atmosphere at 10,000 feet elevation above India.

H. R. M.

AFRICA.

Rainfall in North-East Africa.

'The Rains of the Nile Basin in 1905.' By Captain H. G. Lyons, Director-General, Survey Department, Egypt. Cairo, 1906.

In 1905 several new rain-gauge stations were established in the Nile basin (making seventy-five stations in all), and returns showing the number of rainy days were also received from forty-four posts scattered over the Sudan plains. It is hoped that by collecting information from so wide an area, it may be possible to deduce the probable development of the East African monsun in its northern extension, though, as Captain Lyons says, "much study is still necessary before it can be said precisely what information is more useful, and what weight should be given to such evidence as excess or deficiency of rain in different areas."

The meteorological information given in this report is interesting and important, including a set of maps of the mean monthly rainfall over the region which show well the advance of the rains northward in early summer, and their return in the autumn across the equator. The northern edge of the equatorial rainbelt just reaches Khartum, which has its one short rainy season. The precipitation over the Nile basin in 1905 was deficient everywhere, with the exception of the Delta, which had a heavier winter rainfall than in 1904, owing to the passage of the Mediterranean cyclonic depressions nearer the African coast, and the Nile flood was only 0·65 of the average volume. This makes the tenth successive year of low floods, only two since 1895 having risen, very slightly, above the average, while the others were well below. Captain Lyons emphasizes the fact that the Nile water-supply is but little affected by the rainfall of the equatorial lake plateau, the evaporation in the marshy regions of the Bahr-el-Jebel and Bahr-el-Ghazal basins being so great that the run-off is only 0·95 per cent. of the precipitation.

AUSTRALASIA AND PACIFIC ISLANDS.

Plant-dispersal in the Pacific.

'Observations of a Naturalist in the Pacific between 1896 and 1899.' Vol. 2, Plant-dispersal. By H. B. Guppy, M.B., F.R.S.E. *Illustrations and Maps.* Large 8vo, pp. 627. London: Macmillan & Co. 1906. *Price* 21*s. net.*

This book figures as vol. 2 of Mr. Guppy's book on the Pacific, but it would perhaps have been as well had the two volumes appeared under distinct and differing titles. The first, it may be remembered, dealt with Vanua Levu, and was a comprehensive and most careful study of that island from a geological and physical point of view. It was, indeed, the trained geologist to whom it mainly appealed. The volume under consideration is for the botanist and the student of distribution, and though it may be as little intended for the layman as its predecessor, it has, it must be admitted, but faint connection with the latter. The place of "Vol. 2" on the back of the book is, however, taken by the customary two stars, so that the purchaser who wishes to confine himself to this latest record of Mr. Guppy's

investigations can do so without fear of any appearance of incompleteness in regard to his bookshelves.

All who have made any study of the Pacific are familiar with Mr. Guppy's work. He is a trained and careful observer, with wide experience and a good knowledge of his ground. For the writing of the volume before us he has qualified himself by a course of observation which is truly Darwinian in its patience and method. His interest in the dispersal of plants having been first aroused in his earlier cruises in the Solomons, he afterwards followed up his investigations while on Keeling island and in Java; continued them for some years in the British Isles, in the Mediterranean, and in Fiji; examined the west coast of South America from Southern Chile to Ecuador; and finally visited Panama in order to study the differences between the shore plants on either side of the isthmus. Even were Mr. Guppy not the competent naturalist that he is, so wide a course of study would alone be sufficient to compel our attention.

The book, as we have already said, is mainly for the botanist, and without a certain amount of acquaintance with the littoral flora of the Pacific islands, the reader will not find it very easy to follow the author in his arguments. He takes the floating seed as his text, and the plants on the sea-shore as his main study, and the years of investigation he has devoted to them have enabled him to build up a superstructure of facts which will serve for a long time to come as a perfect storehouse of information for future investigators to draw upon, whether they choose to accept his deductions or not. Although he is modest enough to describe himself as a plotter of detail rather than a delineator of great designs, and to lament that much of what seems new in his work has already been foreseen by the generaliser, there is no doubt that Mr. Guppy here gives us one of the most valuable studies on plant-dispersal hitherto published.

After recording numerous experiments on the buoyancy of seeds, their fertility after long immersion, and so forth, the British littoral flora is discussed at some length. The Fijian, Tahitian, and Hawaiian plants of similar situation are then treated of, before passing to the currents of the Pacific and their action, the *rôle* of birds, vivipary, the relation between shore and inland plants, and the eras in the floral history of the Pacific—a subject which extends over several chapters. There are also special chapters on beach and river drift, and on the economic plants of the Polynesian, and, lastly, a very interesting section on the Rhizophores—the different genera and species of mangrove having been a special study of the author. Some plants and trees of special peculiarity, such as *Afzelia bijuga*, *Entada scandens*, and some of the Cæsalpinias, are also dealt with separately. A final chapter gives a summary of Mr. Guppy's arguments and conclusions, and there is a long appendix of notes on the text.

Much of this, as may be supposed, is of technical interest only, but there is also much which bears directly on geography. Such, for example, are the pages on the west coast of South America, which form one of the most instructive portions of the book. Going northwards from Valdivia, Mr. Guppy distinguishes four well-marked shore-belts: (1) the *Convolvulus soldanella* belt, with cool moist beaches (South Chile); (2) the desert, plantless belt, where the temperature of the sand near the surface ranges from 120°–130° Fahr. (North Chile); (3) the Sesuvium belt, ranging from Africa to near Tumbez in lat. 3° 30′ S., which has a beach quite as hot as that of the desert belt, but shows a scanty flora in which one or two species of Sesuvium are generally to be found; and lastly, (4) the mangrove belt of Equador and Colombia, where, near Tumbez, there is an abrupt transition from drought and semi-sterility to humidity and rank tropical vegetation. A very remarkable feature, however, is to be noticed in this belt, for it is interrupted from Puna island to the

equator, a distance of some 200 miles, by a stretch of perfectly arid coast, which resembles the sterile sea-coast of Peru and has similar climatic conditions. These striking variations, noticeable even by the most unobservant traveller passing along the coast, have been remarked upon by many naturalists, especially by Ball and Eggers, though not many have dealt with the subject so fully as the author. His explanation of them deserves to be recorded here, as it differs in many respects from that given by previous writers. He regards the aridity of the tropical coasts of Northern Chile and Peru, and the complete absence of the mangrove, as caused by the prevailing wind having to cross the cold waters of the Humboldt current before striking the land. Over the current mists are of frequent occurrence, and on attaining the land the air does not part with any more moisture till it has climbed the mountains and reached a cool temperature many thousands of feet above the sea. The Humboldt current is thus the condenser—the umbrella, so to speak, of this western coast, and that this is so, Mr. Guppy considers, is proved by the fact that when the Humboldt current leaves the coast below Tumbez mangroves thrive, but when it strikes it again beyond Puna island, and courses along it to the equator, we find the remarkable arid stretch of sea-coast above alluded to.

We should like, if space permitted, to follow Mr. Guppy in his discussion of the former sea connection across Central America, and other questions of a geographical nature upon which light is thrown by study of the strand flora. Here, as elsewhere, the author supplies abundant and suggestive material. Perhaps, indeed, the material is a little too abundant, or rather the presentment of it, for the volume does not sin on the side of conciseness, and its message might have been delivered still more effectively with a reduction by a century or so of pages. However, this is atoned for by the excellent plan of summarizing the arguments and conclusions of each chapter at the end of it. Mr. Guppy now and again touches upon evolution, chiefly to reiterate his assertion that the world is only a differentiating world, and that Nature nowhere enlightens us as to the mode of development of the type itself. Into this branch of the subject, however, we need not follow him.

F. H. H. G.

THE MONTHLY RECORD.

THE SOCIETY.

President Roosevelt and the R.G.S.—At the meeting of the Society on February 11, the President read the following letter from the Hon. Theodore Roosevelt, President of the United States, who a short time ago was elected an Honorary Member of the Society: "I very deeply appreciate the compliment conferred upon me by my election to honorary membership in your great and distinguished Society—a Society standing pre-eminent among all organizations of the kind throughout the world. I thank you for myself. I thank you on behalf of the great English-speaking Republic of the Western Hemisphere for this compliment conferred upon its President." It may be mentioned that, including President Roosevelt, the list of honorary members includes only ten names in all, mostly representatives of the royal families of Europe and elsewhere.

EUROPE.

Some Lakeland Tarns.—In the *Geological Magazine* for September, 1906, Messrs. Rastall and Smith described their examination of some small tarns on the Haystacks mountain, near Buttermere, which present some interesting features. The upper surface of the mountain is very irregular, with many small peaks and intervening hollows, and presents many evidences of glaciation, the ice having evidently moved from the south-east. The largest tarn, Blackbeck, is about 250 yards long, and drains over the crags on the north side of the mountain into the Warnscale beck, one of the main feeders of Buttermere. The tarn is pronounced to be not a rock-basin, but to be held up by some kind of loose material which blocks the outlet, this being apparently morainic rather than scree. Beneath this material traces of an old buried channel, once the outlet, can be seen. Another tarn, called by the writers "Haystack," for want of a recognized name, contains several islets of rock *in situ*, and is surrounded by very fine *roches moutonnés*, evidently formed by ice coming from the south. At present it drains in this direction over rock, but there are indications of a former outlet, now blocked by loose material, in the north-east corner, so that this too is probably not a rock-basin, as might have been supposed. On the southern side of the mountain there is a somewhat remarkable pool, occupying the portion of a peat-hag which has been hollowed out in some way or other. Small islands of peat project above the water, and are all remarkably undercut, as if by wave-action, to which it seems necessary to attribute the origin of the tarn, though the excavation of the former surface of the peat may have been assisted by desiccation and the removal of matter as dust during dry periods. Such a reversal of the usual process of peat-accumulation is certainly interesting, and may possibly be a cause of the formation of lake-basins, on a small scale, in other districts.

Disappearance of the Wolf in France.—The diminution of the number of wolves in France is the subject of a note in the *Tour du Monde* (December 29, 1906). The author recounts the various laws that have been passed for their destruction, and then, with the assistance of two maps, shows the great progress that has been made since 1889 in exterminating these pests. Whereas in the former year the "wolf district" stretched from Ain, in the north, due south to the borders of Haute Savoie, and then west between the Loire and the Garonne, to the sea, in 1906 this district had been cut in two and diminished by more than a third. The author is of opinion that before many years have elapsed the wolf will be as unknown in France as it is in England.

Rügen and the Strelasund.—The island of Rügen is separated from the mainland by a narrow channel known as the Strelasund, on the south-western side of which lies the town of Stralsund. Prof. W. Deecke, who has for many years made a special study of the structural features of the island and its vicinity, and has shown in various papers that it is a "Schollenland," or one broken up by fractures into a number of separate blocks, with a general direction from north-west to south-east corresponding to the Hercynian system, has lately obtained evidence that the origin of the Strelasund is likewise (as had been previously suspected) due to similar causes (*Sitzungsberichte K. Preuss. Akad. Wissenschaften*, 1906, No. 36). Borings for a well at the railway station at Altefähr, on the Rügen side of the Strelasund, have yielded samples of the underlying Cretaceous rocks, which have been submitted to careful examination, and found to belong to the Upper Turonian, an older member of the Cretaceous system than that occurring on the opposite side of the Strelasund, which is, like the rocks of the greater part of the island, of Upper Senonian age. The writer gives various reasons for supposing that a dislocation has taken place along the line of the Strelasund (north-west to south-east), by which the rocks on the south-west side have sunk relatively to those on the north-east. Similar and

parallel lines of fracture follow the north-eastern side of the island, and the line of the Jasmunder Bodden, and a fourth possibly occurs between the latter and the Strelasund. The depressions along two at least of these lines of disturbance seem to be now partially filled by Tertiary deposits. In its geological history, Rügen certainly belongs to the Danish zone of the Baltic, being divided from the region to the south-east by the transverse line of fault traversing the Oder estuary.

ASIA.

Dr. Sven Hedin in Tibet.—News arrived early in February, *viâ* Calcutta, of Dr. Sven Hedin's arrival at Ngangon-tso on January 21, after accomplishing a successful piece of exploration in Western Tibet. Details of the route followed are not yet forthcoming, but the traveller, who, it will be remembered, entered North-West Tibet last year by way of the Aksai Chin, says that he has crossed the country diagonally, exploring 840 miles of hitherto unknown country, and bringing to light many new lakes, rivers, and mountain ranges. Ngangon-tso, according to existing maps, lies in about 86° E., forming one of the series of lakes stretching west from Tengri-nor, on or near the route of Nain Singh, in whose map it was already shown hypothetically. As in his previous journeys, the traveller has secured an abundant harvest of cartographical, geological, and other scientific results, and has sounded some of the lakes on his route. He experienced very severe climatic conditions during the past winter, and lost all his baggage animals, though all his men got through in safety. On arriving at Ngangon-tso he was at first stopped by the Tibetans, but was soon allowed to proceed. At the time of writing he was on his way to Shigatse, which he hoped to reach at the end of February.

The Count de Marsay's Journey in Western China.—A journey from Tongking to the Upper Yangtse region was made last year by the Count de Marsay, accompanied by his friend, Count L. de Las Cases (*La Géogr.*, vol. **14**, p. 238). From Yunnan-fu northwards the travellers surveyed a route which, Count de Marsay says, had been followed by no European except Père de Guébriant, whose company they had for the journey. They crossed the Yang-tse at a point almost on the meridian of Yunnan-fu, and proceeded by Hwei-li-chou to Ning-yuan-fu. Hence they started west, intending to make for the great bend of the Yang-tse, but their progress was blocked by the great range which bounds the Yen-tsin plateau to the west, and which is crossed by no Chinese route. Bending to the north-west, they reached Yun-lin, a district embracing a number of small villages scattered over the mountains, and governed by a native chief recognized by the Chinese. The people belong to the Mosso race. Crossing a pass over 13,000 feet in altitude. they reached the Yangtse just at the apex of its bend. Returning *viâ* Yun-lin, the travellers visited the Wa-li gold-mines, and crossing and recrossing the Yalu in its great northern bend, made their way to Chentu, and down the Yangtse to the sea. Count de Marsay says that he made a compass survey of the hitherto untraversed parts of the route which will rectify various errors in our maps. It is not quite clear, however, whether he is acquainted with the work of all his predecessors (especially British) in the region visited.

Survey of Ceylon.—The Surveyor-General of Ceylon, in Part I. 'Civil Administration Reports,' 1905, reports that during that year the "rubber boom" upset current progress and order of surveys. In view, however, of the dependence of the extension of rubber cultivation on survey work, some sacrifice in the ordinary routine work was justifiable. The field survey in 1905, to the exclusion of all office out-turn, covered in all 455,578 acres, including 157,348 acres block, 217,600 acres of one-inch and contour, and 41,600 acres of other topographic surveys, and

39,030 applications, etc. In 1900, 2,885,845 acres were overtaken by field-work, the area of such work having since been in steady diminution. On account of sickness in the staff, the completion of the field-work of Uva province, so far as carried out by the "one-inch" staff, was just missed. The contour surveys were confined chiefly to the "railway zone." The final location, however, of the railway trace to Passara is to be postponed till the completion of the contour surveys to that place. The country is a very difficult one to run a line through, and it is still a question whether there is any route by which a railway to Passara would prove financially satisfactory to all concerned. A map of Nuwara Eliya, already five or six years in hand, only awaits for its completion a considerable amount of draughtsmanship. The coast road to Arugam bay is under survey, with a view to preventing the absorption of road reservations by landowners. The construction of a new road parallel to the existing one, and running mostly through Crown land, is under consideration. An experiment in coconut cultivation on a large scale in the North Central Province has had to be abandoned. A map of Ceylon, 16 miles to an inch, shows roads, cart-tracks, railways, and surveys 1897–1905, as also proposals for 1906. There are, besides, minor maps, showing the progress of surveying in the different provinces, and numerous photographic views.

Prof. Musil's Map of Arabia Petræa.—The Imperial Academy of Sciences in Vienna has just published a map of Arabia Petræa based on the observations of Prof. Alois Musil, whose researches have already been referred to in the *Journal*. The large map comprises those parts of Palestine, the Sinai peninsula, and Arabia known from the Bible and other history as the land of the Moabites (east of the Dead sea), land of the Amalekites, later Idumæa (south-west of the Dead sea), and land of the Edomites (south of the Dead sea). In its southern part, as also in its entirety, the land is known as Arabia Petræa. The region extends from the north end of the Dead sea to the Gulf of Akabah, and from 34° to 37° E. It is published on a scale frequently used for general maps of civilized lands, that of 1 : 300,000. A map of the environs of Wadi Musa (Petra), on the scale of 1 : 20,000, is also included. The three sheets of the principal map present a full nomenclature, especially for the east and south-east of the Dead sea, and this has been rendered possible only with aid of the fine workmanship of the Military Geographical Institute. The work is executed in three colours. Brown is used for hill-shading; blue for standing and flowing waters and aqueducts; black for temporary rivers and streams, as also for letterpress. Inhabited, half-inhabited, and deserted places are distinguished by distinctive symbols. The principal scientific value of the map lies not only in the corrections of and additions to the hitherto current conception of the region, but also in its wealth of archæological entries. Besides the modern telegraph-stations and halting-places on the New Mecca railway, there are found marked tells, ancient graves, roads in ruin, bridges, and walls. A large number of altitudes is also incorporated. The map represents a region to which renewed attention is now being paid, and it will, therefore, prove of general interest outside the circles of geographers and archæologists.

AFRICA.

Surveys in Northern Nigeria.—At the end of the present number will be found a map * of the districts on both sides of the lower Niger, in the neighbourhood of the Benue confluence. It is the work of Mr. D. Cator, of the Government service of Northern Nigeria, and is mainly based on surveys with prismatic compass, the latitudes of certain places (shown on the map by a distinguishing mark) being, however, fixed by meridian altitudes with the sextant. The basis is supplied by the

* Map, p. 368.

positions of Lokoja and Kabba as fixed by the late Lieut.-Colonel Vandeleur, and that of Ida as accepted in maps of Southern Nigeria. In the immediate neighbourhood of Lokoja the results of a rough plane-table survey are used, while some distances on roads have been fixed by means of the measuring-wheel. Mr. Cator also sends us some notes on the Egbira and Kukuruku districts of the Kabba province, which he visited in the course of his journeys. Some three years ago the people of the former, which lies off the main routes, gave trouble, and a punitive expedition became necessary. Mr. Cator was sent there subsequently (November, 1905), and remained three months, finding the people quite friendly. Having in the past been much raided for slaves, they have placed many of their villages in most inaccessible places, often at a great distance from, though within sight of, the fertile tracts which they cultivate with success. Palm trees flourish, but the practice of tapping them for wine prevents them from ripening their fruit. Parts of the country are densely populated, the village of Okeli alone containing 30,000 inhabitants, spread over a large area. Among their customs, Mr. Cator mentions that of piercing girls' upper lips and inserting a small piece of lead (though this metal is not found locally), which is supposed to favour child-bearing. Another is the payment by the bridegroom to the bride's family, apart from dowry, of 240 cowries (less than one penny in value), without which no marriage would be complete. Endless law cases are entailed by the non-return of this sum in the case of divorce or the remarriage of the widow. The Kurukuru country presents quite a different appearance to that of Egbira, containing many forest-covered hills. Iron, abundant throughout Nigeria, is smelted in many of the villages.

Return of Lieut. Boyd Alexander.—Lieut. Boyd Alexander, the sole European survivor of the expedition which started across Africa by way of Nigeria three years ago, reached this country early in February, having made his way from the French Congo territory to the Nile, emerging at Port Sudan on January 14 of this year. Lieut. Alexander will describe his journey at an evening meeting during the present session of the Society.

Major Powell-Cotton's Expedition to the Congo Forest.—Major Powell-Cotton, who, it will be remembered, started on his latest expedition to Central Africa over two years ago, accompanied by his wife, has arrived in Rome, whence some details as to the work accomplished have been telegraphed to this country. The traveller, whose principal object was zoological research, went south from the upper Nile through the eastern portion of the Congo State, spending a considerable time among the pygmies of the great forest, whom he carefully studied, obtaining many photographs, phonograph records, etc. He was fortunate enough to secure a splendid specimen of the rare white rhinoceros, and to bring to light at least six species of forest animals new to science. These are, the dusky African tiger-cat, about the size of a leopard, the honey badger or black Ituri ratel, the elephant shrew, a diving antelope armed with tusks, a new black-and-white monkey, and a huge red buffalo. The traveller did not see a living okapi, though once he was within 20 yards of one; but he sent home to the British Museum the skin and complete skeleton of an adult male, which appears to be the most perfect specimen yet brought to this country. Mrs. Powell-Cotton appears to have thoroughly won the confidence of the pygmies, of whose language she learnt a little, and among whom she did medical work. From the forest the expedition made its way to Lake Albert Edward, where the travellers made the acquaintance of a small community of lake-dwellers, whose houses are built on floating platforms. While on the banks of the Sassa river Major Powell-Cotton was severely mauled by a wounded lion, and narrowly escaped with his life.

French Expedition to Taodeni.—We alluded (*Journal*, vol. **28**, p. 508)

to the expedition carried out by Colonel Laperrine to Taodeni, in the inhospitable portion of the Western Sahara north of Timbuktu. The journey was made from the north, but it was arranged that a camel-corps detachment from Timbuktu should proceed at the same time to Taodeni, there to effect a junction with the northern party similar to that successfully accomplished two years before in a more easterly part of the desert. The southern party, which carried out its task with great pluck and determination in the face of great difficulties, was led by Captain Cauvin and Lieut. Cortier, the latter of whom gives a vivid account of the march and its results in *La Géographie* for December, 1906. The country between Timbuktu and Taodeni falls naturally into three zones. In the south the Azauad extends as far as a line through Arauan (the original destination of the detachment). After the first 15 miles the growth of trees ceases, and the country is traversed by lines of dunes running regularly (as throughout the whole tract up to Taodeni) a little north of east. The abrupt slopes here face the north, showing that the prevailing winds are from the south. In the Azauad the dunes are becoming progressively fixed by vegetation, owing to the moisture brought by the southerly winds. Pasturage for camels is found in the neighbourhood of Bu-Jebeha and Arauan, but north of the latter it becomes less and less, and for the greater part of the way to Taodeni—a distance of over 300 miles—not a vestige of vegetation is to be seen. The only water-supply, and that precarious, is at the well at Unan, and the party suffered severely during the passage from the excessive heat. At about 70 miles from Taodeni there is an escarpment falling sharply to the Taodeni basin, and forming the dividing-line between the second and third of the zones above alluded to. In the second the dunes have their steep faces to the south, so that the prevailing winds seem to blow from either side towards a line of low pressure about Arauan. North of the escarpment the surface of the plain is broken by rocky elevations falling in steps to the lower level, and seeming to mark the ancient level of this part of the desert. Arrived at Taodeni, the party obtained no news of Colonel Laperrine, and were obliged to begin the return journey without waiting for him. During the stay a visit was paid to the famous salt deposits, which had not previously been seen by any European. The salt, which is obtained by digging, occurs in successive layers separated by beds of clay. It is taken out in bars weighing some 70 lbs. each, of which 32,000 were transported to the south in 1905–1906 by the Berabish and Kunta caravans. The mines, which belong to no one, seem to have been exploited only during the last three hundred years, since the destruction of Taghaza, where salt was formerly obtained. At Taodeni itself there is no salt, and the water of the wells there has no saline taste, though charged with sulphate of magnesia. In order to lose no chance of meeting with the northern party, a portion of the force, under Lieut. Cortier, returned by a more easterly route through Gattara, where the desired junction was eventually effected. During the passage of the waterless tract south of this, Lieut. Cortier's party were driven to great straits, and a disaster was narrowly avoided. A result of the two expeditions has been to confirm the French authority in this region, and to place a check on the raids from the north to which it has been subject. The latitude of Taodeni was fixed by Lieut. Nieger, of Colonel Laperrine's column, as 22° 40′ 19″ N., or north of its position as laid down by Lenz.

Railway Survey in the French Congo.—Since the early days of the French Congo territory, when M. de Brazza suggested the construction of a railway from Loango to Brazzaville, a number of schemes for the opening up of the country by means of a railway have been mooted, but long remained without practical result. The question has lately been raised afresh by M. Gentil, who in 1905 suggested the survey of a route up the valley of the Ogowe, and across the divide to a convenient

point on the course of the Likuala tributary of the Congo. The idea was taken up, and in 1905 and 1906 the task was executed by Capt. Cambier, who has described the results of his mission before the Paris Geographical Society (*La Géographie*, December, 1906). He pointed out the advantages possessed by a route up the Ogowe valley, as compared with earlier suggested routes in the south of the territory, both as regards the facilities for the execution of the enterprise and the exploitation of the territory to the best advantage. The terminus should be on the Gabun, on account of the facilities offered to shipping by that river, and from the importance of linking Libreville with the interior. The line would strike the Ogowe at Njole, the point where it ceases to be navigable, and reaching the Ivindo by one of two alternative routes, strike across the water-parting to Makua, at the head of navigation on the Likuala. The result of the survey is to show that the scheme is quite practicable, though certain difficulties would be encountered, especially in the middle section. The best starting-point on the Gabun is Owendo, a little east of Libreville, and in order to reach Njole the line would turn the southern extremity of the Monts de Cristal. Above Njole, it would either hug the Ogowe on its northern bank, or make a circuit to the north up the valley of the Okano, afterwards striking across to the Ivindo. The crossing of the divide, at an elevation of 745 metres (2444 feet), would offer no special difficulties, nor, from an engineering standpoint, would the passage across the forest-clad plateau to the east. Captain Cambier calculates the total cost of the line at a little over £4,000,000, the total length being 830 kilometres, or 520 miles. One of the principal engineering works would be the bridge over the Ivindo, with a length of over 350 yards.

Proposed German Expedition across Africa.—It is announced from Berlin that the Duke of Mecklenburg-Schwerin will shortly undertake an expedition across Africa, to occupy two years.

AMERICA.

Surveys in the Yukon and Mackenzie Districts, North-West Canada.—It is naturally in these far-outlying districts that the most important geographical work is accomplished by the field parties of the Canadian Geological Survey. During 1905 some useful survey work was carried out in the little-known region between the basins of the Yukon and Mackenzie rivers. The summary report for that year, since received, includes an account of the work accomplished by Mr. Charles Camsell, the official in charge, the results being also shown by a large-scale map. The start was made from Dawson on May 22, and the Stewart river was ascended in canoes to its junction with the Beaver, the voyage being much impeded by the strength of the current, which brought with it large quantities of driftwood. To reach the basin of the Peel, Mr. Camsell chose a new route which led up Braine creek and across a pass 3300 feet above the sea to Nash creek, a tributary of the Wind river. Though an easy winter route, it proved not feasible for canoes, as it involved a portage of 15½ miles. The country between the two basins is rather rugged, with an average relief of about 3000 feet. The wide longitudinal valleys coincide with the strike of the rocks, and are joined by narrower and shorter transverse valleys. During the glacial epoch the ice filled the valleys only, to a depth of from 1000 to 1500 feet. The Wind river flows through the mountains in a broad U-shaped valley, timbered in parts with spruce and balsam poplar (none of the latter occurring on Braine creek). On leaving the mountains it emerges somewhat abruptly on a rolling country of foothills, replaced later by a level wooded plateau, which extends northwards practically to the Mackenzie delta. The Wind river joins the Peel near the lower end of a cañon, which is followed after 15 miles by a second, the walls of the latter being 500 feet

in vertical height, though navigation is not dangerous. During its passage across the plateau, the Peel cuts a deeper and deeper valley, till the banks attain a maximum height of 1000 feet. At an angle just south of 66° it receives from the south-east the Snake, once thought to be the main stream, but which proved to carry only about a fourth the volume of the south-western branch. At about 67° the Peel emerges from the plateau, which drops abruptly some 700 feet to what is probably the coastal plain. Below Fort Macpherson it enters the flood plain of the Mackenzie delta, in which nearly all the land is submerged during the spring floods. It soon divides into two channels, both of which sooner or later join the waters of the Mackenzie. A striking feature in the delta is the number of lakes which cover its surface everywhere. As far as 68° 30′ it is heavily wooded with spruce. The return route was by the Rat river, which enters the Peel from the west at the head of the delta, and down the Porcupine to the Yukon. Owing to the amount of rain and snow which had fallen, the water-level was raised, so that a portage of 600 yards only was necessary in crossing the divide.

Recent Crossing of Labrador.—Some additions to our knowledge of the geography of Labrador are furnished by its latest explorer, Mrs. L. Hubbard, jun., in the *Bulletin of the American Geographical Society* (vol. **38**, No. 9). Taking up her husband's exploratory mission in 1903, cut short by death, Mrs. L. Hubbard, in the two months, June 27 to August 27, 1905, traversed Labrador from Lake Melville to Ungava bay, and has gathered up the geographical results in the article referred to and its accompanying map of the Nascaupee and George rivers, which form a continuous water-line from Lake Melville to Ungava bay. A number of cuts illustrate particular features on the line of route. The map makes no claim to be other than the result of pioneer work. The instruments with which the traveller was equipped were a surveyor's compass, a sextant, and an artificial horizon dependant on water as the reflecting medium. Taking no observations for longitude, she obtained some for latitude as cartographic guiding-points. The controlling points of the journey had, however, been already determined. Mrs. Hubbard's map of the Nascaupee and George rivers differs considerably from maps issued in 1905. The Nascaupee from its source, a little below 55° N., to its mouth is, including windings, about 300 miles long, and it receives tributaries of considerable size. The George, rather longer, runs due north. The maximum temperature during the journey was 77° Fahr. in the shade; minimum under 30° Fahr.

An Ascent of Aconcagua has, we learn from *Globus* (vol. **91**, No. 3), been recently made by a Swiss alpinist named Heltling. On January 30, 1906, the traveller is said to have started with one companion from a camp at 4000 metres (13,000 feet), and spent the next night at an elevation of 19,500 feet, reaching the summit alone the next morning by almost the same route as was followed by Mr. Vines of the Fitzgerald Expedition. Herr Heltling is said to give the height of the mountain as 23,035 feet, though by what means it was determined is not stated.

AUSTRALASIA AND PACIFIC ISLANDS.

Measurement of Glacier Movements in New Zealand.—The recently issued report for 1905–6 of the New Zealand Survey branch of the Department of Lands contains an account by Mr. T. N. Brodrick of the results of the latest measurements carried out on the Mueller and Tasman glaciers on Mount Cook. Plans are given showing the comparative positions of the terminal face of the Tasman glacier in 1890 and 1906, and of the Mueller glacier in 1889, 1890, and 1906, a general advance being evident in both cases, although from the fact that the Hooker river flows along the face of the Mueller glacier, a retrograde movement might well have occurred. The positions of the numbered stones on this glacier in

various years are also shown, and a table compares the variation in the rate of movement in different seasons. It is shown that between 1895 and 1906 the ice was flowing about 1 inch a day slower than between 1889 and 1895, and the advance above mentioned is therefore surprising. The facts seem only to be accounted for by recent colder summers and lighter falls of snow in winter. The gradual compression of the ice in its course from the *névé* to the terminal face is well shown by the lessening distance between the marked stones as they advance downwards. Two stones which in 1889 were 5680 feet apart were only 3890 feet apart in 1906. This explains how the scattered medial moraines of the upper glacier gradually coalesce until they cover the whole lower surface. The rates recorded vary considerably, but nearly all lie between 2 and 8 inches *per diem*.

Austrian Exploration in New Guinea.—Dr. Rudolf Pöch, who as assistant physician to the Austrian Plague Expedition in 1897 and 1902, made a name for himself by his malaria researches in West Africa, has in 1904–6, with the aid of the Imperial Academy of Sciences in Vienna, prosecuted anthropological journeys in New Guinea, and has also with like purpose visited New South Wales, the Solomon Islands, and Bismarck archipelago. In these two years he has travelled along three-quarters of the coast of the island of New Guinea. At five spots he stopped for some length of time, and thence wandered into regions of the interior, still in part wholly unknown. The material brought home with him includes 300 measurements of living persons, 15 skeletons, 80 skulls, many anatomical preparations, 1500 photographs, more than 3000 feet of cinematograph films (taken by bioscopic camera), representing dances and scenes of village life. Included in the collection are also 90 plates for the phonographic archives of the Academy, with a view to the study of the language, songs, and music of the natives, and 2000 ethnological objects. Itineraries of the hitherto unknown regions were kept, and altitudes noted in them.

New Expeditions to New Guinea.—It is stated in the January number of *Petermanns Mitteilungen* that Dr. R. Schlechter, who is known for his investigations into the possibilities of rubber-planting in West Africa, will lead an expedition to German New Guinea, again under the auspices of the Kolonialwirtschaftliche Komitee, with the object of examining the rubber-resources of the territory and furthering the cultivation of rubber in the same. The starting-point on the coast will be Bongu on Constantine Haven, and the expedition will endeavour to follow the inner side of the Finisterre range, thence pushing on into the Ramu valley, and possibly extending its examination to the Bismarck range. A Dutch expedition into southern New Guinea, under Mr. H. Lorentz, has also, we learn from the same source, been decided on. It will choose, as a route into the interior, the Utumbuwe river, discovered in 1905. This has lately been visited by a Dutch war vessel, the river being ascended in a launch to 4° 52′ S., 138° 44′ E. The snowy range was still some 80 miles distant from that point, and the bearings taken seem to show that it lies further east than has been supposed.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Desiccation of Eurasia.—Prof. L. Berg, in an article contributed to the *Izvestiya* of the Russian Geographical Society (vol. **41**, No. 3), controverts the views of Prince Kropotkin on the desiccation of Eurasia (*Geo. Jour.* vol. **23**, pp. 722–734). He quotes from numerous authors to show that the climate of Asia and Egypt has been from time immemorial much the same as at present. Irrigation works were constructed by Khammurabi in Mesopotamia at the end of the twenty-third century B.C. The climate of Palestine seems not to have changed since Biblical times; the flora and the agricultural system of Egypt are the same as they

were 4000 years ago; and, according to Biot, the temperature of China is the same as it was 3300 years ago. From Quintus Curtius, Arrian, and the Arab geographers, it may be gathered that the same sandy wastes existed in their times, and that the Sea of Aral had about the same extension. The destruction of the cities in Central Asia Prof. Berg ascribes to the wars of Jenghis Khan, Timour, and other conquerors. All sand formations, he affirms, tend to become consolidated by vegetation, and it is only through injudicious rooting up of the vegetation that they are set in motion again. Such, at any rate, is his experience on the shores of the Sea of Aral and in Semirechiye. The Caspian and Aral seas undoubtedly occupied greater areas in the Post-Pliocene period than at present, and contracted on the retreat of the ice, leaving sands and clays containing shells behind them, which have often been mistaken for more recent deposits. Also, expeditions in Central Asia became particularly frequent in the sixties and seventies of last century, when high temperature and scarcity of rainfall prevailed, and hence, in Prof. Berg's opinion, sprang up the impression that the country was drying up. But the periods of unusual drought that have occurred have as little connection with the desiccation that took place in the Post-Pliocene period as the present increase of rainfall and rise in the lakes are indications of an approach of the former conditions. With regard to the extension of the Aral and Caspian seas shown in the sketch-map on p. 729 of the *Geographical Journal*, Prof. Berg states that he found Aral-Caspian deposits only in the immediate neighbourhood of the Aral, and he can affirm that Balkash never was connected with the Aral sea, and probably never stood more than 1 or 2 mètres above its present level.

Mud-cracks as a Criterion of Sedimentation.—A critical summary of what is known of the various forms of sedimentation, with special reference to mud-cracks, appears in the *Journal of Geology*, September–October, 1906, from the pen of Mr. Barrell, of Yale University. The bulk of present sedimentary deposits is formed either upon the land or beneath the sea. The littoral—that belt of shore exposed between the highest and lowest monthly tides—forms but a relatively narrow transitional zone. The chances of the preservation of littoral deposits are slight, for if the land is upraised they are the first to suffer erosion; while if the land sinks, the sea generally planes away the deposits left in front of it. Frontal portions of river deltas are the most favourable places for the preservation of broad littoral zones. Mud-cracks may, in the absence of fossils, be regarded as a distinguishing feature, by means of which it may be determined whether formations are fluviatile, lacustrine, estuarine, aëolian, or pertaining to the open shallow sea. In order that mud-cracks may be formed, the deposit should originate under very quiet waters, either removed by evaporation or slowly drained away with bottom velocities of less than one-third of a mile an hour. Factors governing the nature of the mud-cracks are the shrinkage nature of the deposit, its porosity, length of period of desiccation, temperature of the air. A mud-cracked loam does not easily preserve its detailed surface, except when remaining moist, so that little swelling takes place. A pure clay, slowly subsiding from quiet waters, and wet sufficiently long to become compact upon drying, would retain its mud-cracks upon rewetting either by rain or flood waters. Sandy wash filling the cracks of the previous clay layer would give a permanent record of the mud-cracks. An arid valley climate and abundant sediment are more favourable conditions for mud-crack development than an area covered with vegetation. The faintest markings are retained where the water slowly drains away. Cracks also form in the beds of "playas." Such lakes are always shallow and are always yellow with mud in suspension. When the water has disappeared, absolutely barren mud plains remain, which harden and crack in all directions. Numerous playa lakes are found in Nevada, in Australia, and in the African desert of

Kalahari. There is little likelihood of the incorporation of an organic record, either of leaves, bones, or tracks. Sand will tend to preserve the cracks into which it precipitates. Vegetation will eliminate them in many cases, and in basins of pre-Tertiary rocks they will not appear. On the margins of interior lakes wide expanses may become sun-cracked before a subsequent rise of water deposits another layer of clay. Lakes Titicaca and Tanganyika are examples. The exposed area is more subject to wave-action than are playa beds, and beaches are built, in which many organic remains are found. As in playas, sand preserves the cracks. On river flood plains the conditions of mud crack formation are at a maximum. Carbonaceous deposits occur in pluvial climates, and mud-cracks, as contrasted with coal-beds, may thus serve as an index to ancient climates. Formation of mud-cracks is non-essential on slopes of piedmont river waste, but is characteristic of the larger river plain and delta deposits of arid climates. The chances of ultimate preserval of the geologic record are comparatively great, as regards mud-cracks and organic remains. On the littoral zone, no cracks will remain on that portion which is wet twice a day. The more favourable places for development of mud-cracks are either those comprising extensive salt marshes, or regions of unusual tidal range. Where mud-cracks are occasionally formed beyond the tidal range by the inundations of the sea, they only attain a broad development in arid regions where continental river deposits have been previously built. Owing to these phenomena, mud-cracks of the littoral zone cannot be an important feature of geological formations. Remains of beach structures are found, and of such animals as frequent the shore. Next to coal-beds formed *in situ*, or land fossils, mud-cracks, on the whole, form one of the surest indications of the continental origin of argillaceous deposits. Mud-cracked shales predominantly indicate former flood-plain deposits, usually on delta surfaces which have displaced shallow seas. There is some degree of variance in modern text-books with this theory of mud-crack interpretation. Sir A. Geikie makes no mention of mud-cracks on flood-plains of rivers and apart from permanent bodies of standing water. Mud-cracked formations are found in the pre-Cambrian period region of Montana, also ripple-marks and the irregular surfaces of shallow-water deposits; long-enduring incursions of the sea are thus represented. In the Spokane and Grinnell argillites are seen traces of a wide deltaic fan. In the Grand Cañon series of Arizona ripple-marks and shrinkage cracks characterize the upper shaly beds. The mud-cracks of these pre-Cambrian deposits are confined to just such formations as from other characteristics suggest a flood-plain origin. These are usually separated from the limestone by transitional formations which differ in colour, in character, and in absence of mud-cracks, suggesting the true submarine deposits originating between the shore and the open sea.

The Source of the Water of Geysers.—In the November number of the *Geological Magazine*, Mr. J. M. Maclaren, of the Geological Survey of India, expresses a doubt as to the correctness of the views of Suess (*Geographical Journal*, vol. **20**, p. 518) and others as to the necessarily deep-seated origin of geyser water, and, generally, of waters impregnated with mineral substances giving rise to metalliferous deposits. He points to recent geyser phenomena in New Zealand in support of his contention that such waters may be of quite superficial origin. The great Waimangu geyser, discovered in 1900, which remained in active eruption for over four years, sometimes sending up a mass of water 800 tons in weight to a height of 1500 feet, became dormant on October 31 and November 1, 1904, the very days on which the pent-up waters of the Tarawera lake overtopped their barrier, which two days later was completely carried away, so that the level is now 11 feet below its maximum. Instances are also quoted in which other New Zealand geysers have shown a dependence on superficial waters, and it is shown that the necessary heat to

create the motive force exists at no great depth. A case of recent metallic deposition from the waters of fumarolic areas is also quoted.

Connection between widely distant Earthquakes.—From the fact that, after an earthquake to which general attention has been called, shocks are frequently reported from widely separated localities, the public is apt to conclude that a connection exists between the several phenomena. The constancy with which minor shocks are occurring throughout all the areas liable to such disturbance renders this a somewhat hazardous conclusion, but an attempt has lately been made by the Rev. H. V. Gill to show by experiment that a seismic disturbance in one part of the globe is likely to be followed by others in widely separated regions. Having procured a hollow teetotum, made with great care, and a number of small steel balls, he found that whereas, on dropping a single ball into the spinning teetotum, an irregular motion was of course caused, an even spin was recovered when more balls were dropped in. In each case the balls, whatever the number, took up positions equally distant round the circumference. Mr. Gill, who has described the experiments in the *Scientific Proceedings of the Royal Dublin Society* (June, 1906), suggests that something like this happens in the case of disturbances in the Earth's crust, and the resulting displacement of matter. The effect of a single disturbance would be to produce a stress on other points round the Earth's circumference, the places of weakest crust being the first to yield. If the first to yield were not diametrically opposite the original seat of disturbance, the presence of the two disturbances would produce a displacement at some third point. In support of this theoretical conclusion, Mr. Gill points out that the sites of the three great disturbances of April, 1906 (Vesuvius, Formosa, San Francisco), are all situated on a narrow belt parallel to the equator; that the disturbances between them are comparable; and probably also the intensities of the disturbance.

CORRESPONDENCE.

Coffee Production in São Paulo, Brazil.

Palace of Agriculture, São Paulo, Brazil, January 14, 1907.

Having purchased for the library of the Department of Agriculture, Industry, and Commerce of the State Mr. J. G. Bartholomew's 'Atlas of the World's Commerce,' it appears to me and to others here that the "General Summary on Coffee," p. 85, and even the maps on p. 87, fail to emphasize the importance of our State as a coffee-producing region, and of Santos as a coffee port. Further, the remarks about the tree, its cultivation, and fruition are not applicable to our plantations. I therefore send you the following corrections from the Paulista point of view, and beg you to insert this letter in an early issue of the *Journal*.

The coffee-tree of São Paulo is by no means "a small shrub;" it commonly reaches 12 feet in height, and usually ladders are required to pick the berries. There are no German colonies in São Paulo cultivating coffee, but in 1901 there were 15,828 coffee estates, not counting the small holdings. Most of the planters are Paulistas. Many German labourers are employed in cultivating and picking coffee, but Italians predominate, and there are many Spaniards, Portuguese, and other Europeans. The planting of coffee is not suitable for colonists to undertake, as the trees only bear full crops at five years old. I do not know where "the coffee flowering season extends over eight months, and the berries are gathered three times a year," as stated, but in São Paulo the crop begins in April or May, and is continuous, extending over a period of 120 to 145 working days. Further, in

São Paulo the trees yield good crops long after their twentieth year. We have trees yielding well planted fifty years ago. São Paulo is *the* coffee State, and Santos *the* coffee port of the world. We have already sent, in little over six months, 10,000,000 bags into Santos—say 600,000 tons—and the supply is still pouring in at a great rate, and will, it is thought, amount to 16,000,000 bags, or 960,000 tons, up to June 30 (the end of our agricultural years).

Small quantities of coffee are exported from Rio de Janeiro, from Victoria, in the State of Espirito Santo, and from Bahia, and a few bags from the northern ports.

On p. 88, at bottom, it is stated that the fall in price, June, 1901, is due to over-production. The Legislature of the State of São Paulo has recognized this to some extent by discouraging further planting for the present by taxing all new plantations; but the view taken in this State is that adulteration, favoured by enormous duties (136 frs. per 100 kilos in France) is the cause of the check to consumption. We have in our museum here a number of tins containing so-called "coffee mixtures," and an analysis made in London gives the quantity of coffee in the best sample as 70 per cent., whilst in the most there is only 13 per cent. of coffee.

The fact is, then, that the State of São Paulo alone produces about four-fifths of the world's supply of coffee, and practically all this is exported *viâ* Santo. Any commercial atlas or work dealing with coffee should emphasize these two cardinal points.

In conclusion, I beg to assure you that any information about this State wanted by writers or compilers of statistical works will be readily furnished on application to the Secretary for Agriculture, São Paulo, perhaps the only State in Brazil that can give any correct statistics.

Frederic H. Sawyer.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1906–1907.

Sixth Meeting, January 28, 1907. The Right Hon. Sir George T. Goldie, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

Elections.—*Bertram Victor Andrews; Rev. Daniel Cross Bates; George Beck; Bernard Robert Blakiston; Lieut.-Colonel S. G. Burrard, R.E.; [illegible] Stewart Chessman; Colonel Arthur Horsman, C.M.G., D.S.O.; Arthur Cot[illegible]r; T. J. Eldridge; Lieut. E. J. English, R.N.R.; Arthur Faulkner; W. B. Gordon, C.I.E.; Z. Franklin Lieber; Nicholas Alfred Lionarons; Kenneth MacAndrew; Hans Gustav Myhoe; Prof. Francis Alfred Nixon; H. B. Ommanney; Samuel Herbert Pearse; Rev. Charles Cousens Petch; Geoffery Wm. Rhodes; John Rhodes; Captain Hugh W. Smith, D.S.O.; J. H. G. Tilbury; Lieut.-Colonel F. C. Trollope; Captain Sir George J. S. Warrender, Bart., R.N.*

The paper read was:—

"A Journey through Central Asia to Northern China." By Major C. D. Bruce.

Research Department.

February, 8, 1907.—Colonel Sir T. H. Holdich, K.C.M.G., K.C.I.E., C.B., R.E., in the Chair.

The papers read were:—

"Cutch and the Ran." By Robert Sivewright.

"Birth of a New Island in the Bay of Bengal." By Lieut. Headlam.

Seventh Meeting, February 11, 1907.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS.—*L. M. Calvocoressi; Emery Chubb; Lieut.-General Edward H. Clive; Robert Elliott Cooper; Wyndham Dunstan, M.A., LL.D., F.R.S.; Henry William Hipwell; Lewis Harry Goring Lloyd-Goring; Captain Dan Harrison Macdonell; Albert Ochs; Samuel P. Page; Malcolm Arnold Robertson; Charles Hope Shields; Eric Teichmann, B.A.; Oskar Teichmann, M.A.; Anthony Hamilton Vivian.*

The paper read was:—

"To the North Magnetic Pole, and through the North-West Passage." By Captain Roald Amundsen.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendes.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic—Tides. *M.k.u.k. Militärg. I.* 25 (1905): 49–76. ———
Die Beobachtungen am Flutmesser in Ragusa im Jahre 1905. *With Diagram.*

Alps—Simplon. *B.S.G. Italiana* 7 (1906): 753–773, 845–858. **Michieli.**
La Galleria del Sempione e i nuovi transiti internazionali. Comunicazione del Prof. A. Michieli.

Austria—Tyrol. *Beiträge Geophysik* 8 (1906): 79–112. **Greim.**
Studien aus dem Paznaun. II. Der Jamtalferner bis 1897. Von Dr. G. Greim. *With Map.*

Bulgaria. *Z. Ges. Erdk. Berlin* (1906): 405–425, 466–481. **Kassner.**
Bulgarien. Auf Grund eigener Reisen. Von Prof. Dr. C. Kassner. *With Illustrations.*

Denmark—Skagerak and Kattegat. **Petersen.**
Report of the Danish Biological Station to the Board of Agriculture, xiii.; 1903

and 1904. By Dr. C. G. Joh. Petersen. Copenhagen, 1906. Size 12 × 9, pp. 86. *Chart.*

English Channel. *Quest. Diplomatiques et Colon.* **10** (1906): 26–41. **Du Boulley.**

L'Archipel Anglo-Normand. La question des Ecrehous. Par P. Aubery du Boulley. *With Sketch-maps.*

The Ecrehous are rocky islets about 6 miles from the coast of Cotentin, which the writer thinks should be justly considered French.

Europe. **Fallex and Mairey.**

M. Fallex et A. Mairey. L'Europe (moins la France) au début du XX^{e} siècle. Paris: Librarie Ch. Delegrave, [1906]. Size 8 × 5, pp. 8 and 624. *Maps and Illustrations. Price* 5 *fr.* [To be reviewed.]

Europe. **Maxwell.**

A Cruise across Europe. Notes on a Freshwater Voyage from Holland to the Black Sea. By Donald Maxwell. London: John Lane, 1907 [1906]. Size 9 × 5½, pp. 256. *Sketch-maps and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

An attractively got-up book, giving entertaining sketches of travel across Europe by a little-used method.

Europe—Historical. **Helmolt and others.**

Weltgeschichte . . . herausgegeben von Hans F. Helmolt. Sechster Band. Mitteleuropa und Nordeuropa. Von Prof. Dr. Karl Weule, etc. Leipzig, etc.: Bibliographisches Institut, 1906. Size 10 × 7, pp. xviii. and 630. *Maps and Illustrations. Price* 10 *marks.*

France—Aude and Ariège. *B.S.G. Lille* **46** (1906): 176–191. **Farges.**

L'Aude et l'Ariège. I. Equisse géographique, historique, et ethnographique de la région. II. Voyage de Carcassonne à Saint-Girons par Axat, Saint-Paul-de-Fenouillet, Perpignan, Cols de la Perche et de Puymorens, Ax-les-Thermes et Foix. Par Louis Farges. *With Illustrations.*

France—Cartography. *Ann. G.* **15** (1906): 379–383. ———

La nouvelle carte de France au 50,000^{e}. Publication des neuf premières feuilles.

France—Census. ———

République Française. Résultats statistiques du Recensement général de la population effectué le 24 Mars. 1901. Tome iii. Population présente. Régions de l'Ouest et du Midi. Paris: Imp. Nationale, 1906. Size 11 × 9, pp. xvi. and 890. *Presented by the Ministère du Commerce, etc.*

France—Central Plateau. *La G., B.S.G. Paris* **14** (1906): 61–78. **Buffault.**

Le plateau d'Aubrac. Par P. Buffault.

Noticed in the Monthly Record (January, p. 83).

France—Charente Inférieure. *B.S.G. Rochefort* **28** (1906): 100–109. ———

Notice sur la fabrication du sel marin dans les marais salants de la Charente-Inférieure.

France—Gascony. *B.S.G. Com. Bordeaux* **32** (1906): 245–252, 265–271. **Saint-Jours.**

Lège, le Porge, et les fables du littoral gascon. Par Capitaine Saint-Jours. *With Facsimile Map.*

France—Jura. *B.S.G. Lille* **46** (1906): 114–130. **Dumortier.**

Excursion dans le Jura. Par M. l'Abbé Dumortier. *With Illustrations.*

Germany—Hessen. **Hessler.**

Hessische Landes- und Volkskunde. Das ehemalige Kurhessen und das Hinterland am Ausgange des 19. Jahrhunderts. Im Verbindung mit dem Verein für Erdkunde zu Cassel und zahlreichen Mitarbeitern herausgegeben von Carl Hessler. Band I. Hessische Landeskunde. Zweite Hälfte. Marburg: N. G. Elwert, 1907. Size 9½ × 6½, pp. xii. and 870. *Map and Illustrations. Price* 10*s.* 9*d.*

Germany—Mecklenburg. **Geinitz.**

Die Einwirkung der Silvestersturmflut 1904 auf die mecklenburgische Küste. Von E. Geinitz. (Mitteilungen aus der Grossherzogl. Mecklenburg. Geologischen Landesanstalt, xvi.) Rostock, 1905. Size 11½ × 9, pp. 8. *Plates.*

Noticed in the Monthly Record (December, 1906, p. 630).

Italy—Sicily. **Sladen and Lorimer.**

Queer Things about Sicily. By Douglas Sladen and Norma Lorimer. London:

A. Treherne & Co., 1905. Size 8½ × 5½, pp. xxvi. and 422. *Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Turkey—Albania. **Steinmetz.**

Ein Vorstoss in die nordalbanischen Alpen. Von Karl Steinmetz. (Zur Kunde der Balkanhalbinsel: Reisen und Beobachtungen. Herausgegeben von Dr. Carl Patsch. Heft 3.) Wien und Leipzig: A. Hartleben, 1905. Size 9½ × 6½, pp. 64. *Map and Illustrations. Price 2s.*

United Kingdom. **Heaton.**

A Scientific Geography. Book II. The British Isles. By E. W. Heaton. London: Ralph, Holland & Co., 1906. Size 7½ × 5, pp. 138. *Maps. Price 1s. 6d. net. Presented by the Publishers.*

United Kingdom—Yorkshire. **Speight.**

Upper Nidderdale, with the Forest of Knaresborough. Being a Record of the History, Antiquities, Scenery, Old Homes, Families, etc., of that Romantic District. By Harry Speight. London: E. Stock, 1906. Size 7½ × 5, pp. 368 and lxxxvi *Map and Illustrations. Price 5s. net. Presented by the Author.*

A good example of the topographical descriptive works which have been so well represented in the literature of recent years. Though largely concerned with local history, it gives incidentally a good deal of information on the physical features of the district, of which the writer possesses an intimate knowledge.

ASIA.

Armenia. **Oswald.**

A Treatise on the Geology of Armenia. By Dr. Felix Oswald. Beeston, Notts.: published by the Author, 1906. Size 9 × 5½, pp. viii. and 516. *Maps, Illustrations, and Diagrams. Price 21s. net. Presented by the Author.* [To be reviewed.]

Central Asia—Tian Shan. **Keidel, Richarz, Kleinschmidt, and Limbrock.**
Abh. Math.-Phys. Kl., A.W. München **23** (1906): 89-232.

Aus den wissenschaftlichen Ergebnissen der Merzbacherschen Tian-Schan-Expedition. I. Geologische Uebersicht über den Bau des zentralen Tian-Schan, von H. Keidel. II. Die Gesteine des Profils durch das Bayum-Kol-Tal im nördlichen Teil des zentralen Tian-Schan, von Steph. Richarz. III. Die Gesteine des Profils durch das südliche Musart-Tal im zentralen Tian-Schan. Von A. Kleinschmidt und H. Limbrock. *With Map, Sections, and Illustrations. Also separate copies, presented by Dr. Gottfried Merzbacher.*

China—Hainan. *T'oung Pao.* **7** (1906): 369-380. **Feray.**

Les Japonais à Haï-Nan sous la dynastie des Ming (1368-1628). Par M. Feray. *With Map.*

China—Manchuria. *J. Tokyo G.S.* **18** (1906): 238-246. **Inouye and Ogawa.**

Geology and Mineral Resource of Southern Shengking Province. By Kinosuke Inouye and Takudzi Ogawa. *With Map.* [In Japanese.]

China—Orthography. ———

List of Names of Places in China, for which it has been decided to adopt the conventional spelling in War Office maps and publications, the correct spelling according to Wade's system being put in brackets, if considered necessary. [1906.] Size 13 × 8 (1 sheet).

Dutch East Indies. **Van der Lith, Snelleman, etc.**

Encyclopædie van Nederlandsch-Indie. Met Medwerking van verschillende Ambtenaren, Geleerden, en Officieren samengesteld door P. A. van der Lith, A. J. Spaan, en F. Fokkens. 4 vols. (Vol. **4**, samengesteld door Joh. F. Snelleman.) The Hague, etc., M. Nijhoff [*not dated*, 1906]. Size 10½ × 7. *Price* 125s.

This important work will take its place as the standard work of reference on the Dutch East Indies. It treats exhaustively (under one alphabet) of places, persons, and subjects.

Eastern Asia—Earthquakes. *Beiträge Geophysik* **8** (1906): 113-218. **Rudolph.**

Ostasiatischer Erdbebenkatalog. Verzeichnis der im Jahre 1904 auf den Erdbebenstationen in Japan, Formosa, Manila und Batavia registrierten Störungen. Zusammengestellt von E. Rudolph. *With Map.*

French Indo-China. **Pavie.**

Mission Pavie Indo-Chine, 1879-1895. Géographie et Voyages. II. Exposé des Travaux de la Mission (Troisième et Quatrième périodes = 1889 à 1895). Par

Auguste Pavie. Paris: E. Leroux, 1906. Size 11 × 9, pp. 402. *Maps and Illustrations. Price 10 fr. Presented by the Author.*

French Indo-China—Annam. **Cadière.**
B. l'École Française d'Extrême-Orient 5 (1905): 349–367.
Les Hautes Vallées du Sông-Gianh. Par L. Cadière.

French Indo-China—Ethnology. *Tour du Monde* 12 (1906): 337–384. **Baudesson.**
Deux ans chez les Moïs. Par le Capitaine Baudesson. *With Map and Illustrations.*

French Indo-China—Ethnology. **Durand.**
B. l'École Française d'Extrême-Orient 5 (1905): 368–386.
Notes sur les Chams. Par E. M. Durand.

India. **Boeck.**
Dr. Kurt Boeck. Aux Indes et au Népal. Traduit par François Ricard. Paris: Hachette & Cie., 1907. Size 9½ × 6½, pp. viii. and 258. *Illustrations. Price 15 fr. Presented by the Publishers.*
The German original was briefly reviewed in vol. **21**, p. 66.

India. **Loti.**
India. By Pierre Loti. Translated from the French by George A. F. Inman; edited by Robert Harborough Sherard. London: T. Werner Laurie, (*not dated*). Size 9 × 5½, pp. 284. *Portrait. Price 10s. 6d. net. Presented by the Publisher.*
See review, *ante*, p. 216.

India. ——
Annual Report of the Board of Scientific Advice for India for the year 1904–05. Calcutta, 1906. Size 10 × 7, pp. iv., 138, and xii. *Chart.*

India—Irrigation. **Buckley.**
The Irrigation Works of India. By Robert Burton Buckley. Second Edition. London: E. & F. N. Spon, 1905. Size 13 × 10, pp. xx. and 336. *Maps, Illustrations, and Diagrams. Price 42s. net. Presented by the Publishers.*

Japan. **Cornish.**
Notes on Japanese Temples and Monasteries. By Dr. Vaughan Cornish. (Read before the Japan Society of London, December 4, 1904.) Size 10 × 6, pp. 18. *Illustrations. Presented by the Author.*

Korea. **Rossetti.**
Carlo Rossetti. Corea e Coreani: Impressioni e Ricerche sull' Impero del Gran Han. Two vols. Bergamo; Instutito Italiano d'Arti Grafiche, 1904–1905. Size 10½ × 7½, pp. (vol. **1**) 170, (vol. **2**) 232. *Maps, Plan, and Illustrations. Price (vol.* **1***) lire 5; (vol.* **2***) lire 7. Presented by the Author.*

AFRICA.

Abyssinia. *A travers le Monde* 12 (1906): 253. ——
L'Accord Anglo-franco-italien à propos de l'Abyssinie. *With Map.*

Africa—Communications. *Z. Kolonialpolitik* 8 (1906): 561–579. **Kürchhoff.**
Die Schiffahrt nach Afrika unter besonderer Berucksichtigung der deutschen Flagge. Von D. Kürchhoff.

Africa—Railways. **Jacob.**
Quest. Dipl. et Col. 10 (1906): 6–25, 91–109, 151–161, 216–230.
Les Chemins de fer Africains. Par Léon Jacob. *With Maps.*

Bechuanaland—Hydrology. **Du Toit.**
T. South African Philosoph. S. 16 (1906): 251–262.
Underground Water in South-Eastern Bechuanaland. By Alex. L. du Toit.

British East Africa—Ethnology. *P.R.S.* 18 (1906): 105–121. **Eliot.**
The Native Races of the British East Africa Protectorate. By Sir Charles Eliot.

Canary Islands. *Petermanns M.* 52 (1906): 145–153, 173–184. **Sapper.**
Beiträge zur Kenntnis von Palma und Lanzarote. Von Prof. Dr. Karl Sapper. *With Map.*

Cape Colony—Meteorology. *T. South African Philosoph. S.* 16 (1906): 217–236. **Sutton.**
The Climate of East London, Cape Colony. By J. R. Sutton.

Central Africa—Zoology. *P. Zoological S.* (1906): 534-535. **Halbert.**
Zoological Results of the Third Tanganyika Expedition, conducted by Dr. W. A. Cunnington, 1904-1905. Report on the *Hydrachnida*. By J. N. Halbert. *With Illustration.*

Congo State. *B.S.G. Italiana* 7 (1906): 864-878. **Cordella.**
Ricognizione nel Bacino dell' Elila (Stato indipendente del Congo) del Capitano E. Cordella. *With Map and Portrait.*

The Elila is the eastern tributary of the upper Congo, sometimes known as Lira. The journey was made by an Italian officer in the service of the State, who has since died of hæmaturic fever.

German South-West Africa—Hereros. **Irle.**
Die Herero. Ein Beitrag zur Landes-, Volks-, und Missionskunde. Von I. Irle. Gütersloh: C. Bertelsmann, 1906. Size 9 × 6, pp. viii. and 352. *Map and Illustrations. Price 5m. Presented by the Publisher.*

Madagascar. **Pappenheim.**
Madagascar: Studien, Schilderungen und Erlebnisse. Von Haupt Graf zu Pappenheim. Berlin: D. Reimer, 1906. Size 9½ × 6½, pp. xii. and 556. *Maps and Illustrations. Price 8m. Presented by the Publisher.* [To be reviewed.]

Rhodesia—Language. **Madan.**
Wisa Handbook: a short Introduction to the Wisa Dialect of North-East Rhodesia. By A. C. Madan. Oxford: Clarendon Press, 1906. Size 7 × 4½, pp. 136. *Price 3s. net. Presented by the Publishers.*

South Africa. **Cordier.**
Henri Cordier. Le Périple d'Afrique. Du Cap au Zambèse et à l'Océan Indien. Paris: E. Guilmoto, [*not dated*, 1906]. Size 9 × 5½, pp. 234. *Illustrations. Price 7 fr. 50. Presented by the Publisher.*

A record of the author's journey with the British Association.

Uganda. **Hattersley.**
Uganda by pen and camera. By C. W. Hattersley, with a preface by T. F. Victor Buxton. London: The Religious Tract Society, 1906. Size 8 × 5, pp. xviii. and 138. *Illustrations. Price 2s. Presented by the Publishers.*

West Africa. **Wallis.**
West African Warfare. By C. Braithwaite Wallis. London: Harrison & Sons [*not dated*, 1906]. Size 7½ × 5, pp. viii. and 118. *Presented by the Author.*

Useful practical hints to officers likely to be engaged in military operations on the West Coast, partly taken from the author's book, 'The Advance of our West African Empire' (*Journal*, vol. **22**, p. 691).

NORTH AMERICA.

Canada. *Hist. and Sc. S. Manitoba*, No. 71 (1906): pp. 12. **Sherbinin.**
The Galicians dwelling in Canada and their Origin. By Michael A. Sherbinin.

Canada—British Columbia. **Boas and Hunt.**
Kwakiutl Texts, Second Series. By F. Boas and G. Hunt. (The Jesup North Pacific Expedition. Memoir of the American Museum of Natural History, vol. **10**, part 1.) Leiden: E. J. Brill; New York: G. E. Stechert & Co., 1906. Size 14 × 11½, pp. 270.

Canada—British Columbia. **Teit.**
The Lillooet Indians. By J. Teit. (The Jesup North Pacific Expedition. Memoir of the American Museum of Natural History, vol. **2**, part 5.) Leiden: E. J. Brill; New York: G. E. Stechert & Co., 1906. Size 14 × 11½, pp. 193-300. *Illustrations.*

Canada—Manitoba. *Hist. and Sc. S. Manitoba*, No. 69 (1906): pp. 8. **Turner.**
The Moose and Wapiti of Manitoba. A Plea for their Preservation. By J. P. Turner. *With Illustrations.*

Canada—Northern Waters. **Low.**
Report on the Dominion Government Expedition to Hudson Bay and the Arctic Islands on board the D.G.E. *Neptune*, 1903-1904. By A. P. Low. Ottawa: Government Printing Bureau, 1906. Size 9 × 6, pp. xvi. and 356. *Map and Illustrations. Presented by the Author.*

See summary of the events of the voyage in the *Journal* for September, 1905 (p. 318).

Canada—Quebec. **Low.**

Geological Survey of Canada. Report on the Chibougaman Mining Region in the Northern part of the Province of Quebec. By A. P. Low. 1905. Ottawa, 1906. Size 10 × 6½, pp. 62. *Map.*

Noticed in the Monthly Record (vol. **28**, p. 639).

Mexico. *B.G.S. Philadelphia* **4** (1906): No. 5, 1–24. **Hovey.**

Notes on Northern Mexico: Its Deserts, Plateaus, and Canyons. By Edmund Otis Hovey. *With Illustrations.*

Account of observations made during the journey referred to in vol. **26**, p. 218; vol. **27**, p. 90.

CENTRAL AND SOUTH AMERICA.

Bolivia and Peru—Boundary. **Saavedra.**

Defensa de los Derechos de Bolivia ante el Gobierno Argentino en el Litigio de Fronteras con la Republica del Peru. Por Bautista Saavedra. 2 vols. Buenos Aires, 1906. Size 8½ × 6, pp. (vol. **1**) 318; (vol. **2**) 294. *Maps. Presented by the Ministro de Colonias y Agricultura, Bolivia.*

Bolivia and Peru—Boundary. ———

Allegato de parte del Gobierno de Bolivia en el Juicio Arbitral de Fronteras con la República del Peru. (Pp. xviii. and 320.) Collección de Documentos que apoyan el Allegato de Bolivia en el Juicio Arbitral con la República del Peru. 2 vols. Pp. (vol. **1**), 546; (vol. **2**), 598. *Maps. Presented by the Ministro de Colonias y Agricultura, Bolivia.*

Brazil. *J. Geology* **14** (1906): 374–401. **Derby.**

The Serra do Espinhaço, Brazil. By Orville A. Derby. *With Sketch-maps and Illustrations.*

Central America—Treaty. ———

Treaty Series: No. 11, 1906. Treaty between the United Kingdom and the Republic of Nicaragua with regard to the Mosquito Territory. Signed at Managua, April 19, 1905. London, 1906. Size 9½ × 6, pp. 6. *Price ½d.*

Falkland Islands—Palæobotany. **Nathorst.**

Phyllotheca-Reste aus den Falkland-Inseln. Von A. G. Nathorst. (Reprinted from *Bull.* of the Geol. Instit. of Upsala, vol. 7.) Upsala, 1906. Size 9½ × 6½, pp. 72–76. *Plate.*

Noticed in the Monthly Record.

Panama. *Deutsch. Rundschau G.* **28** (1906): 433–442. **Fischer.**

Der Isthmus von Panama. Beobachtungen und Daten von einer Studienreise nach Panama. Von E. S. Fischer. *With Illustrations.*

West Indies—Dominica. **Grieve.**

Notes upon the Island of Dominica (British West Indies). Containing Information for Settlers, Investors, Tourists, Naturalists, and Others; with Statistics from the Official Returns, also Regulations regarding Crown Lands and Import and Export Duties. By Symington Grieve. London: A. & C. Black, 1906. Size 7½ × 5, pp. 126. *Map and Illustrations. Price 2s. 6d. net. Presented by the Publishers.*

AUSTRALASIA AND PACIFIC ISLANDS.

Caroline Islands—Yap. *Z. Kolonialpolitik, etc.* **8** (1906): 197–283, 375–432. ———

Die Karolineninsel Jap. *With Map, Sections, and Illustrations.*

See note in the February number (p. 231).

New Guinea. *Z. Ges. Erdk. Berlin* (1906): 490–492. **Pöch.**

Bemerkungen ueber die Eingeborenen von Ost- und Süd- Neu- Guinea. Briefliche Mitteilung von Dr. R. Pöch.

New Guinea—German. *Sitzb. K.A.W. Wien* **114** (Ab. I.) (1905): 437–453, 689–698. **Pöch.**

Erster Bericht von meiner Reise nach Neu-Guinea über die Zeit vom 6. Juni 1904 bis zum 25. März 1905. Ditto, Zweiter Bericht . . . vom 28 März 1905 bis zum 21 Juni (Bismarck-Archipel, 20 März bis 14 Juni) 1905. Von Dr. R. Pöch.

The journey was undertaken chiefly for anthropological research (see *ante*, p. 350).

New South Wales—Minerals. **Andrews.**

Molybdenum. By E. C. Andrews. (New South Wales. Geological Survey, Mineral Resources, No. 11.) Sydney, 1906. Size 9½ × 6½, pp. 18. *Illustrations.*

The sulphide of molybdenum, known as molybdenite, is used in hardening steel.

New Zealand. *Quarterly J. Geol. S.* **62** (1906): 381–424. **Marshall.**
The Geology of Dunedin (New Zealand). By Dr. Patrick Marshall. *Map and Plates.*

Pacific Islands. **Krämer.**
Hawaii, Ostmikronesien, und Samoa. Meine zweite Südseereise (1897–1899) zum Studien der Atolle und ihrer Bewohuer. Von Prof. Dr. Augustin Krämer. Stuttgart: Strecker & Schröder, 1906. Size 9½ × 7, pp. xvi. and 586. *Sketch-map and Illustrations. Price* 10*m. Presented by the Publishers.* [To be reviewed.]

POLAR REGIONS.

Antarctic—British Expedition. **[Scott and Others.]**
The Logs of the S.S. *Discovery.* 4 vols. [Deck Log Book: vol. 1, August 6, 1901, to February 9, 1902. The same: vol. 2, February 16, 1904, to September 10, 1904. Official Log Book: vol. 1, August 6, 1901, to November 28, 1901. The same: vol. 2, December 24, 1901, to February 8, 1902, and February 16, 1904, to April 1, 1904.] Size 17 × 10½ (MS.). *Presented by the National Antarctic Expedition.*

Antarctic—French Expedition. **Charcot.**
Journal de l'Expedition Antarctique Française, 1903–1905. Le "Française au Pôle Sud." Par J.-B. Charcot. Préface par l'Amiral Fournier. Paris: E. Flammarion, [1906]. Size 11 × 7½, pp. xxxviii and 486. *Map and Illustrations. Price* 15 *fr. Presented by the Author.* [To be reviewed.]

Antarctic—Scottish Expedition. **Bruce.**
Report on the Work of the Scottish National Antarctic Expedition. By W. S. Bruce. (Read at the Meeting of the British Association, Section E, Cambridge, 1904.) Edinburgh, *not dated* [1906?]. Size 10 × 6, pp. 10. *Map and Illustrations. Presented by the Author.*

Arctic—Swedish Expedition. **Hamberg.**
K. Svensk. Vet.-A. Handl. **39**, No. **6** (1905): pp. 62.
Astronomische, photogrammatische und erdmagnetische Arbeiten der von A. G. Nathorst geleiteten Schwedischen Polarexpedition 1898. Von A. Hamberg. *With Map and Illustrations.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology. *Beiträge Geophysik* **8** (1906): 43–59. **Arldt.**
Parallelismus auf der Erdoberfläche. Von Dr. T. Arldt.

Papers by the same writer dealing with parallelism in special regions have been already noticed in the *Journal* (**18**, 536; **28**, 511).

Geomorphology—Deserts. **Wiszwianski.**
Die Faktoren der Wüstenbildnung. Von Dr. Helene Wiszwianski. (Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin; herausgegeben von Ferdinand Frhr. v. Richthofen. Heft 9.) Berlin: E. S. Mittler und Sohn, 1906. Size 10 × 7, pp. 90. *Diagrams. Price* 3.75*m. Presented by the Publishers.*

Geophysics. *Petermanns M.* **52** (1906): 190–191. **Hammer.**
Die isostatische Lagerung der äusseren Erdschichten. Von Prof. Dr. E. Hammer.

Geophysics. *Quarterly J. Geol. S.* **62** (1906): 456–475. **Oldham.**
The Constitution of the Interior of the Earth, as revealed by Earthquakes. By R. D. Oldham. *With Diagrams. Also separate copy, presented by the Author.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *G.Z.* **12** (1906): 378-401, 449-463. **Chalikiopoulos.**
Anpassungsbedingungen und Entwickelungsmotive der Kultur. Von L. Chalikiopoulos.

An elaborate dissertation on the various types of culture and their conditions of development.

Anthropogeography. *J. of G.* **5** (1906): 120-126. **Sutherland.**
Geography and Life. By W. J. Sutherland.

Historical—Dutch Voyages. **Spilbergen, Le Maire, and Villiers.**
The East and West Indian Mirror, being an account of Joris van Speilbergen's

Voyage round the World (1614–1617), and the Australian Navigations of Jacob le Maire. Translated, with Notes and an Introduction, by J. A. J. de Villiers. (Hakluyt Society's Publications, Second Series, No. xviii.) London, 1906. Size 9 × 5½, pp. lxii. and 272. *Facsimile Maps and Illustrations. Presented by the Hakluyt Society.*

This is the first complete English translation of Spilbergen's famous voyage. All the original illustrations are reproduced.

Historical—Voyages. **Purchas.**

Hakluytus Posthumus or Purchas His Pilgrimes. Contayning a History of the World in Sea Voyages and Lande Travells by Englishmen and others. By Samuel Purchas. Vols. **17**, **18**, and **19**. Glasgow: J. MacLehose & Sons, 1906. Size 9 × 6, pp. (vol. **17**) xviii. and 550; (vol. **18**) xx. and 540; (vol. **19**) xxiv. and 550. *Maps and Illustrations. Price* 12*s*. 6*d*. *net per vol. Presented by the Publishers.*

These volumes embrace the latter part of the American voyages, contained in Books 7–10 of the Second Part of the Edition of 1625.

GENERAL.

British Empire. **Herbertson.**

Descriptive Geographies from Original Sources. The British Empire. Selected and edited by F. D. Herbertson. London: A. & C. Black, 1906. Size 7 × 4½, pp. xiv. and 254. *Illustrations. Price* 2*s*. 6*d*. *Presented by the Publisher.*

This is a useful addition to the series of descriptive geographies by the same author. It consists chiefly of extracts from the former volumes, with some additions.

Travels. **Lithgow.**

The Totall Discourse of The Rare Adventures and Painefull Peregrinations of long Nineteene Yeares Travayles from Scotland to the most famous Kingdomes in Europe, Asia, and Affrica. By William Lithgow. Glasgow: James MacLehose & Sons, 1906. Size 9 × 6, pp. xxxii. and 450. *Facsimile Plates. Price* 12*s* 6*d*. *net. Presented by the Publishers.*

Reprint of the first edition of 1632.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria-Hungary. **Artaria.**

Artaria's Eisenbahn- und Postkarte von Oesterreich. Vierte Neubearbeitung. 7 Auflage. Scale 1 : 1,500,000 or 1 inch to 23·7 stat. miles. Vienna: Artaria & Co., 1907. *Price* 2.20*k*. *Presented by the Publisher.*

Austria-Hungary. **Oberhummer and Wieser.**

Wolfgang Lazius Karten der österreichischen Lande und des Königreichs Ungarn aus den Jahren 1545–1563. Im Auftrage der K. K. Geographischen Gesellschaft in Wien zur Feier ihres fünfzigjährigen Bestandes. Herausgegeben mit Unterstützung des K. K. Ministeriums für Kultus und Unterricht von Eugen Oberhummer und Franz R. von Wieser. Innsbruck Wagner'schen Universitäts-Buchhandlung, 1906.

This portfolio of facsimile maps will be specially noticed.

Central Europe. **K. u. K. Militärgeographisches Institut.**

Neue Uebersichts-Karte von Mittel-Europa. Scale 1 : 750,000 or 1 inch to 8·7 stat. miles. Sheet J8, Adrianopel. Vienna: K. u. K. Militärgeographisches Institut, [1906].

Central Europe. **Liebenow and Ravenstein.**

Liebenow-Ravenstein's Special-Radfahrerkarte von Mittel-Europe. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: 79, Kielce; 93, Miechow; 94, Rzeszów; 134, Schemnitz; 135, Rima-Szombat; 148, Komorn; 149, Jász-Berény; 159, Murau; 162, Stuhlweissenburg. Frankfurt-a-Main: Ludwig Ravenstein, [1906].

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1907.

2 miles to 1 inch:—

Large Series, printed in colours, folded in cover or flat in sheets, 32. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*; *mounted in sections,* 2*s.* 6*d.*

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25-inch—County Maps (first revision):—

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(*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

4 miles to 1 inch—New Series. Drift edition, printed in colours, sheet 12. *Price* 2*s.* 6*d.*

1-inch—New Series. Drift edition, printed in colours: Wellington and Chard, 311. *Price* 1*s.* 6*d.*

(*E. Stanford, London Agent.*)

Germany. **Hantzsch.**

Die ältesten gedrückten Karten der sächsisch-thüringischen Länder (1550–1593). Herausgegeben und erlaütert von Viktor Hantzsch. Leipzig: B. G. Teubner, 1905.

These facsimile maps will be specially noticed.

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilung der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet 342, Luckau. Berlin: K. Preussische Landesaufnahme, 1906. *Price* 1.50*m. each sheet.*

London. **Railway Clearing House.**

Official railway map of London and its environs. Scale 1:31,680 or 2 inches to 1 stat. mile. 2 Sheets. Prepared and published at the Railway Clearing House, London, 1907. *Price* 8*s.* 6*d.*

London. **Stanford.**

A new map of Metropolitan Railways, Tramways, and Miscellaneous Improvements deposited at the London County Council, November 30, 1906, for Session 1907. Scale 1 : 63,360 or 1 inch to 1 stat. mile. London: Edward Stanford, 1907. *Price* 1*s.* 6*d.*

ASIA.

Chih-li. **Topographical Section, General Staff.**

Province of Chih-li (southern sheet). Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1906. *Price* 2*s.* *Presented by the Director of Military Operations.*

AFRICA.

Abyssinia. **Rossetti.**

Schizzo dimostrativo delle principali concessioni per ricerche minerarie accordate dall' Imperatore Menelik II. in Etiopia da Carlo Rossetti. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Rome: G. De Agostini & Co., [1906]. *Presented by the Author.*

A useful little map of Abyssinia showing approximately the limits of the various mining concessions granted to European syndicates.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets (Sierra Leone): 58-L, P, 59-I, M, 70-D, 71-A; (Uganda) 86-A, E, I, M, N. London: Topographical Section, General Staff, War Office, 1906. *Price* 1*s.* 6*d.* *each sheet. Presented by the Director of Military Operations.*

Bahr el Ghazal. **Topographical Section, General Staff.**

Bahr el Ghazal. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Compiled in the Topographical Section, General Staff. London: Topographical Section, General Staff, War Office, 1906. *Price* 2*s.* *Presented by the Director of Military Operations.*

Egypt. **Egyptian Survey Department.**

Map of Egypt. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: N.W. I.-I. S.E. I.-I., I.-II., II.-I., II.-II., III.-I., III.-II., XXIV.-VI. and VII. Giza: Survey Department. *Presented by the Director-General, Survey Department, Giza.*

North-East Africa. **Rossetti.**

Schizzo dimostrativo della situazione politica nell' Affrica Orientale da Carlo Rossetti. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Rome: G. De Agostini & Co., 1906. *Presented by the Author.*

A small outline map of North-East Africa, showing in colours possessions of European countries and regions under the various Ethiopian chiefs.

South Africa. **"South Africa."**

The Railway map of South Africa. Scale 1 : 3,928,320 or 1 inch to 62 stat. miles. Revised to date and published by authority at the offices of "South Africa," Winchester House, London, 1907.

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheet: Environs of Gafsa. Paris: Service Géographique de l'Armée, [1906]. *Price* 1.50 *fr.*

AMERICA AND WEST INDIES.

Alaska. **Habenicht and Böhmer.**

Karte von Alaska, hauptsachlich nach der "Map of Alaska," compiled by E. C. Barnard, U.S. Geological Survey, mit Benutzung neuen materials unter Leitung von H. Habenicht bearbeitet von C. Böhmer. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 1. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheet 69, Moosejaw, revised to November 27, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Department of the Interior, Ottawa.*

Chile. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet: Magallanes. Santiago: Oficina de Limites, [1906]. *Presented by the Director, Oficina de Limites, Santiago.*

Haiti. **De Moya.**

Mapa de la Isla de Santo Domingo y Haiti por el General Casimiro N. de Moya. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Santo Domingo City: R. Piñeyro & Co.; Hamburg: L. Friederichsen & Co., 1905. *Price* 45*m*. *Presented by Messrs. L. Friederichsen & Co.*

With the exception of the charts of the coast, very little reliable cartographical material exists for constructing a map of the island of San Domingo and Haiti on a large scale. Still, such as is available seems, on the whole, to have been made use of in the above map, and the author acknowledges in a note the sources from which he has taken his information, specially referring to the British and American Admiralty charts and those published by Messrs. James Imray & Co., of London. It is, however, noticeable that in the neighbourhood of the Bay of Neiba the configuration of the country differs considerably from the map of the same district by Mr. J. Wells, given in vol. 3 of the R.G.S. Supplementary Papers. The map is a somewhat roughly coloured production, but contains a good deal of general information as to roads, railways, relative importance of towns and villages, etc. Plans of Port au Prince and San Domingo city are given as insets, together with tables of distances.

United States. **U.S. Geological Survey.**

Geological Atlas of the United States. Folios: 136, St. Mary's, Maryland-Virginia; 137, Dover, Delaware—Maryland—New Jersey; 138, Reading, California; 139, Snoqualmie—Washington; 140, Milwaukee, Wisconsin. Washington: Department of the Interior, U.S. Geological Survey, 1906. *Presented by the United States Geological Survey.*

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Parts 18 and 19. London: George Newnes, Limited, [1907]. *Price* 6*d. each part. Presented by the Publisher.*

The following are the contents of these two parts of this atlas:—Part 18, Plates: 97, Fruit supply; 98, 99, Apples, bananas, oranges, dates, etc.; 100, Fruit statistics; 157, Timber and cabinet woods, cork, etc.; 158, 159, Timber-growing countries; 160, Timber and cabinet woods. Statistics. Part 19, Plates: 101, Dairy produce; 102, 103, Dairy produce, exported and imported; 104, Domestic animals; 137, Marble, phosphates, etc.; 138, 139, Tin, platinum, aluminium; 140, Mercury, zinc, etc. In addition to the maps and diagrams, each of these parts contains a continuation of the 'Commercial Gazetteer of Countries and Ports.'

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams and 105,000 references. Parts 6, 7, and 8. London: The Amalgamated Press, Limited, 1906. *Price* 7*d. each part.*

These parts contain the following maps:—Part 6, Sheets: 1–2, Physical World in Hemispheres; 125–126, The Far East (Industries and Communications). Part 7, Sheets: 39–40, The North of Ireland; 153–154, North America (general map). Part 8, Sheets: 27–28, The West of England and Wales; 101–102, Indian Ocean (Cable and Ocean Depths): 135–136, Africa (Industries and Communications).

World. **L'Estrange.**

Philip's Progressive Atlas of Comparative Geography. Edited by P. H. L'Estrange, B.A. London: George Philip & Son, Ltd., [1907]. *Price* 3*s*. 6*d. net. Presented by the Publisher.*

This atlas is composed of the coloured maps in the 'Progressive Course of Comparative Geography' by the same author, which are arranged here as in that work.

The surface characteristics and structure of countries, seasonal temperature and pressures, wind and rainfall, vegetation, minerals, communications, distribution of population and political divisions are all dealt with, whilst the positions of cities and towns, ports, trade routes, etc., are shown on separate maps, with a test map printed on the back of each, marked with symbols instead of names.

World. **Putzger.**

F. W. Putzgers historischer Schul-Atlas zur alten, mittleren und neuen Geschichte. Bearbeitet und herausgegeben von Alfred Baldamus und Ernst Schwabe. Dreiszigste Auflage. Bielefeld and Leipzig; Velhagen & Klasing, 1906.

This is the thirtieth edition of this well-known little school historical atlas which has deservedly obtained a good reputation, and is in considerable demand on the continent. It now consists altogether of 238 coloured maps and inset plans, prefaced by brief explanatory text. These are all well arranged and carefully prepared. Considering the small cost, the total amount of information given in the atlas is surprising.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas verkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 35, 36, 37, and 38. Gotha: Justus Perthes, 1906. *Price 60 pf. each part.*

These parts contain the following maps:—Part 35–36, Sheets: 39, Ireland; 52, Balkan peninsula, sheet 2; 56, North and Central Asia; 76, Australia and Polynesia. Parts 37–38, Sheets: 34, Spain and Portugal, sheet 3; 49, Russia, sheet 6; 68, Africa, general map.

There is very little change in these sheets, and, with slight modifications to boundaries, they are as they appeared in the last issue. The map of North and Central Asia would have been improved for a further correction, especially the Tibet section. However, it is only a small-scale general map, and too much must not be expected.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during December, 1906. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
34 m	= 3·0	England, south coast:—The Scilly isles. 3*s*.
3601 m	= 4·6	Scotland, west coast:—Loch Dunvegan, including Loch bay. 3*s*.
2582 m	= 5·3	Orkney islands:—Pierowall road and approaches. 3*s*.
3578 m	= 0·6	Spain, south coast:—Eastern approaches to the strait of Gibraltar. 3*s*.
337 m	= 6·0	Canada, Lake Ontario:—Toronto harbour. 2*s*.
1313 m	= 0·5	Chile. The channels between Maullin bay and Port Montt. Plans:—River Maullin, Port Abtao, Port Montt. 3*s*.
3594 m	= {2·9, 6·0}	British Columbia. Plans on the east coast of Vancouver island:—Ganges harbour and Captain passage. Porlier pass. 2*s*.
69 m	= 7·2	Ceylon:—Pámbam pass. 3*s*.
3615 m	= {3·6, 7·2, 7·3}	Plans in the Philippine islands:—Santa Cruz harbour, Port Banalakan, Port Boca Engano. 2*s*.
945 m	= 2·7	Philippine islands:—Ports Masinlok and Matalvi and Palauig bay. 2*s*.
3588 m	= 0·77	China:—Canton river delta. 3*s*.
1255 m	= 0·18	China, north coast:—Kyau chau bay to Lai chau bay. 3*s*.
913 m	= {0·3, 5·5}	Korea, west coast:—Mackau group to Clifford islands. Plan:—Ochon To anchorage (Palos harbour). 3*s*.
3114 m	= 7·9	Japan:—Moji and Simonoseki ko. 2*s*.
3566 m	= {0·5, 4·4, 11·8, 2·0}	Japan:—Izumi Nada and Harima Nada. Plans:—Yura ko, Sumoto ko, Kata Seto. 3*s*.

New Plans and Plans added.

No.	Inches.	
633 m	= 6·9	Harbours and anchorages on the east coast of Ireland. New plan:—Malahide inlet. 2*s*.
2063 m	= 10·0	Malta island, northern portion. Plan added:—Ras in Nieshfa bay. 4*s*.
708 m	= {0·5, 1·8}	Anchorages on the west coast of Madagascar. New plans:—Nosi Mitsio (Minow islands), Ampasimena (Diamond) bay. 2*s*.
944 m	= 1·4	Ports in the Philippine islands. New plan:—Port Batan. 2*s*.
991 m	= 3·5	Anchorages on the coast of Yezo island. New plan:—Kushiro road. 2*s*.
3409 m	= 3·3	Japan:—Ishinomaki wan (Sendai bay) and Sakata ko to Tsugaru Kaikyo. Plan added:—Obato wan. 3*s*.
210 m	= 2·6	Japan:—Harbours on the east coast of Nipon. New plan:—Yamada ko. 2*s*.
1648 m	= 0·19	Japan:—Osumi Kaikyo (Van Diemen strait) to O shima. Plan added:—Osumi group. 3*s*.
3340 m	= 1·98	Gulf of Tartary, northern sheet. Plan added:—Sertuna river anchorage. 3*s*.
845 m	= 10·0	Fiji:—Kandavu passage to Kowata island. Plan added:—Likuri island anchorage. 4*s*.
1386 m	= 3·6	Islands in the south Pacific ocean. New Plan:—Cook bay or Hanga roa. 2*s*.

Charts Cancelled.

No.		Cancelled by	No.
34	England, south coast:—The Scilly isles.	New chart. The Scilly isles	34
1202	Scotland, west coast:—Loch Dunvegan on this sheet.	New plan. Loch Dunvegan, including Loch bay	3601
2582	Orkney islands:—Pierowall road.	New chart. Pierowall road and approaches	2582
337	Canada: Lake Ontario:—Toronto harbour.	New plan. Toronto harbour	337
1313	Chile: the channel between Port de Ancud and Port Montt. Plans:—River Maullin, Port Abtao, Port Montt.	New chart. The channels between Maullin bay and Port Montt. Plans:—River Maullin, Port Abtao, Port Montt	1313
3029	British Columbia: Active pass to Gabriola pass and inner channels:—Plan of Porlier pass on this sheet.	New plan. Porlier pass on chart	3594
69	Ceylon:—Pámbam pass.	New plan. Pambam pass	69
945	Philippine islands:—Ports Masinglok and Matalvi.	New plan Ports Masinlok and Matalvi and Palauig bay	945
1255	China, north coast:—Kyau chau bay to Miau tau strait.	New chart. Kyau chau bay to Lai chau bay	1255
913	Western coast of the Korea:—Mackau group to Clifford islands. Plan:—Palos harbour.	New chart. West coast of Korea:—Mackau group to Clifford islands. Plan:—Ochon To anchorage (Palos harbour)	913
3114	Japan:—Anchorages in Simonoseki strait:—Moji ko.	New plan. Moji and Simonoseki ko	3114
357	Japan: Harbours in the Kii channel:—Plan of Yura harbour on this sheet.	Plan of Yura ko on new chart	3566

Charts that have received Important Corrections.

No. 1967, England, south coast:—Plymouth sound. 2978, Iceland:—Sigle fiord to Niardvig. 2172, Alaska:—Bering strait. 2908, Africa, south coast:—Port Natal entrance. 2062, Cochin China:—Tong king gulf. 3349, China:—Approach to Kwang chau wan. 1655, Korea:—Southern approach to Ping Yang inlet.

(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat. and Red Sea for February, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for February, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Publisher.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for January, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for February, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

British East Africa. **Murray.**

Fourteen photographs of British East Africa, taken by Captain E. M. Murray. *Presented by Captain E. M. Murray.*

(1–3) Kavirondo at Karungu; (4 and 5) Kavirondo women waiting to be paid at Karungu; (6) Kavirondo women, Karungu; (7) Masai women, Southern Guaso Nyiro; (8) Interior of a Masai village, Southern Guaso Nyiro; (9) Southern Guaso Nyiro, Masai women at the ford; (10) The Southern Guaso Nyiro near the German boundary; (11) Baggage crossing Southern Guaso Nyiro by rope; (12) Bridge building over the Mara river; (13) Kopje on the German boundary; (14) Cactus tree on the German boundary.

Clapperton Memorial. **Burdow.**

Photograph of tablet erected in Sokoto by Major J. A. Burdon, the first resident of the Sokoto province, to the memory of Commander Hugh Clapperton, R.N., bearing the following inscription: "In memory of Hugh Clapperton, Commander R.N., the first European to visit Sokoto, March 16, 1824. He died there April 13, 1827, and was buried at Jungevi." *Presented by Major J. A. Burdon.*

Færöe Islands. **Hepburn.**

Thirty photographs of the Færöe islands, taken by the late David Hepburn, Esq. *Presented by David Hepburn, Esq.*

The Society has already been indebted to Mr. Hepburn (whose comparatively early death is to be deeply regretted) for many excellent photographs of the Færöe islands. Some of the following, taken during last summer, if not altogether geographical, are of exceptional interest. Among these may be mentioned the series depicting a whale hunt in its various stages.

(1) Vaag, looking east; (2) Vaag, looking west; (3) The Great Dimon; (4) Troldkonefingeren, Vaagö; (5 and 6) Cliffs at Vaag; (7) Viderejde; (8 and 9) Cliffs on north-west coast of Osterö; (10) Cliffs on west coast of Stromö; (11) "In tow" going to the whale hunt; (12) Boats assembling in Bordovig bay for the whale hunt; (13) The boat which sighted the whales; (14) Driving the whales into Klaksvig bay; (15) Killing the whales in Klaksvig bay; (16) Harpooning the whales at Klaksvig; (17) Driving the whales into shallow water, Klaksvig; (18) Whale between two boats; (19) A final struggle; (20) Despatching a disabled whale; (21) Waiting to harpoon a straggler; (22) The crowd on shore watching the whale drive; (23) Boats coming in after the "kill;" (24) Whales brought to shore; (25) Whales drawn up on the sand; (26) Whale on shore, showing harpoon wounds and final incision; (27 and 28) Cutting up a whale; (29) Gathering up the fragments; (30) Lading a boat with their share preparatory to starting for home.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Fünfte Reihe, Heft 1 u. 2, Eifel und Venn. Eine pflanzengeographische Skizze von M. Koernicke und F. Roth. Jena: Gustav Fischer, 1907. *Price 2.50m. each part.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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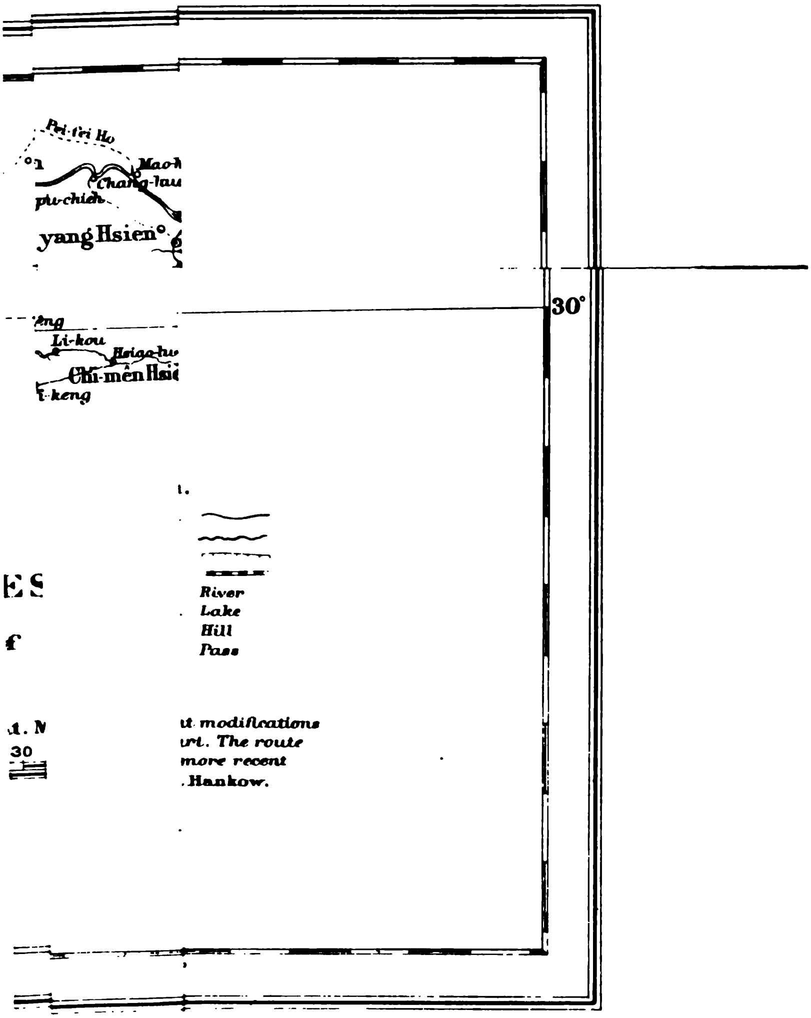
THE GEOGRAPHICAL JOURNAL 1907.



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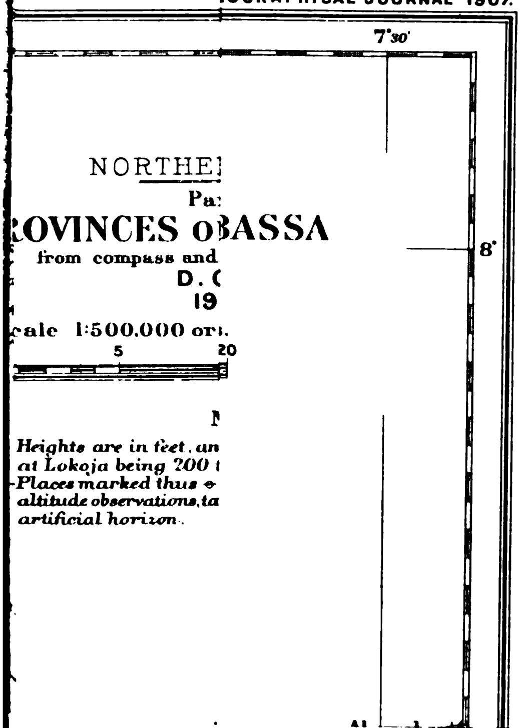

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The
Geographical Journal.

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NORTH-EASTERN RHODESIA.*

By L. A. WALLACE.

The land map of North-Eastern Rhodesia you have before you contains also part of North-Western Rhodesia; this part, bounded by the Kafue, Zambezi, Luangwa, Lukashaski and Mlembo rivers, and to the north by the Congo Free State, was but lately a portion of North-Eastern Rhodesia, and is thus included in to-night's paper.

During my first visit to North-Eastern Rhodesia in 1897 my journeys were confined to the northern part of the Tanganyika plateau between Lakes Mweru and Tanganyika and Fife, and further north in German territory to the low land which contains Lake Rukwa. Travelling further south over the country then was not everywhere possible—there was still some slave-trading being carried on, and the Awemba people had not been brought under control; but on my return two years later their power had been broken, and the whole of the country between Tanganyika had been tactfully, and with but little opposition, brought under the control of the British South Africa Company, and was quietly and peacefully administered from the many stations distributed over its area.

Travelling was easy, and the natives were friendly, so that any one could safely wander through country in which but a short time before it would have been unpleasant to travel without at least some show of force. It was to the same part of the country that I again went on my next visit; but from there I travelled further south on the plateau, and down the east and south of it on the low country, to which it falls as abruptly generally as it does to Rukwa and to Tanganyika.

* Read by O. L. Beringer at the Royal Geographical Society, November 12, 1906. Map, p. 484.

This high plateau comprises the greater portion of North-Eastern Rhodesia and is sharply divided from the rest of the country by a sudden drop, at the east and south-east, to the Luangwa and Zambezi valleys, and to the north by several prominent and almost continual drops—namely, that from the south end of Lake Mweru to and around the south of Lake Tanganyika, and, further to the north-east (in German territory), to Lake Rukwa and into its southern feeders rising at Fife, just over the Anglo-German boundary.

Between Lake Tanganyika and Rukwa, however, this high plateau from North-Eastern Rhodesia continues with but few depressions in a north-westerly direction until it reaches the large Malagarasi river (by far the greatest feeder of Lake Tanganyika), and forms in this long stretch the water divide between Tanganyika and the northern affluents of Rukwa and the said Malagarasi river. There is no similar continuation of this high North-Eastern Rhodesia plateau to the north between Lakes Mweru and Tanganyika, the country directly between these lakes being comparatively low and rising little over 3000 feet above sea-level, the approximate height of Mweru. Further north, however, the watershed between the Luapula river and Tanganyika is very high, and the west coast of this lake, like the country around the south and east of it, is very mountainous and rugged and consequently extremely picturesque, though, shut in as it is, ferociously hot—as Mr. Beringer, who surveyed the telegraph line up its eastern side, can vouch for.

These steep falls from the high land are very marked features of the country; they vary in depth from 2000 to 3000 feet, and occasionally near the edges are hills rising some hundreds of feet higher. They extend from near Tanganyika, on the north in German Territory, nearly all the way to Lake Nyasa, and are known over a great part of this stretch as Chingamba; on the east, but separated by the high land between Fife and Fort Hill from the northern portion, it forms the great drop to the Luangwa valley down to about 14° S., and is known all over this extent as Machinga. Continuing south-eastwards, but deeply cut into by the Lukashashi and Lusersfwa rivers and their affluents, and still generally called Machinga, it fades out in the high lands drained by the Kafue river.

On the northern boundary of this plateau the country varies from 5000 to 6000 feet in height above sea-level, but there are hills which rise much higher, such as Sunzu, for example, near Lake Tanganyika, 7393 feet (Close and Boileau). There is little over 5000 feet on the eastern boundary, and on the south the highest falls to about 4000 feet, though on the Zambezi-Luapula watershed, of which the Trumi mountains are a part, a height of nearly 5000 feet is maintained.

The sudden drop from the plateau on the north is shown by the heights of Tanganyika, 2680 feet (Close and Boileau), and of Rukwa, which I found to be at the same level as Tanganyika. On the east the

Luangwa river near Mirongo is 2500 feet, at Nawalia 1500 feet, above the sea, and both these places are within a few miles of the top of the Machinga.

On the north and east the watershed between the Congo and the rivers flowing north and east lies near the edge of the plateau, but on the south, from the Trumi mountains it turns across the high land in a north-westerly direction almost at right angles to the Machinga, and so divides this high country into a *northern and a southern part*, the former comprising nearly all the high ground of the present North-Eastern Rhodesia land, including a strip of country belonging to the Congo State

LUANGWA RIVER.

(between the Congo-Zambezi watershed and the Luapula river), and the latter most of that part of the country already described as having lately been included in North-Western Rhodesia.

Dividing the whole of this high land from the rest of North-Eastern Rhodesia is the extraordinarily deep valley of the Luangwa river, to which we shall again refer. To the east and south of this valley North-Eastern Rhodesia is bounded respectively by the Nyasa-Luangwa Zambezi watershed, and a line on that watershed on the 14th degree of latitude running to the 15th degree of latitude on the Luangwa river. Away from the Luangwa valley this part of North-Eastern Rhodesia rises generally to between 3000 and 4000 feet, but the rise is, except from that high country between Fort Hill and a little south of the Katumbi,

gradual. This high country to the north includes part of the Nyika plateau, which rises to a height of 8500 feet above sea-level, and Namitawa, 7239 feet, besides many other conspicuous peaks. Near the centre of the main northern plateau lies Lake Bangweulu, at a height of 3700 feet above the sea, and from the north, east, and south the land generally slopes gently towards it. The rivers running to it, after their first short fall from the ridge, flow slowly, sometimes through hilly and broken country, sometimes through gently undulating or level plains, and often through narrow swamps, many of which seem to have been at one time shallow lakes whose shrunken remains still show at places like Lake Young on the Mansya river and Lake Moir near Serenji. These small swamps get more frequent and larger as the rivers approach one another, and at last become one vast dead level morass, which, in its north-western part, changes from a dense papyrus marsh to a sheet of open water, and is then Lake Bangweulu. It was in this vast swamp that Livingstone got entangled at the worst part of the rainy season, with all the rivers in flood—a time of year when even now, in more settled circumstances, natives are with difficulty persuaded to travel far from their villages. In the beginning of February he was apparently not far from Chirui island, and certainly not more than two days by canoe from the firm ground which extends from the Luapula outlet round the south and west of Bangweulu, and the natives knew it, but kept him wandering, lost on the marshes till, nearly three months later, he ended his life and his wanderings near the edge of the swamp at old Chitambo's.

The principal river running to Bangweulu is the Chambezi, whose main source is in the high land 15 miles south of Tanganyika. It receives all the drainage from the north-eastern part of the plateau, and soon becomes a good-sized stream, with long reaches navigable by boat and canoe, and passes through much picturesque country and good farming land before it reaches the Bangweulu marshes and joins the Luapula.

The Luapula flows out from the south of Bangweulu, and, after running 50 miles due south through the swamps, takes a long bend round to the north again, and in a shallow valley, as a large and sometimes navigable river, reaches Lake Mweru, 350 miles, in which distance it falls only 700 feet, Mweru being 3000 feet above the sea. Water, therefore, which rose only 15 miles south of Tanganyika, after travelling 700 miles round the south of Bangweulu to the north of Mweru, is still only 90 miles from Tanganyika, and after having fallen nearly 3000 feet, is still 400 feet above it. Tanganyika, a sudden and very deep depression in very high country, sometimes with precipitous sides, differs much from the shallower lakes of Mweru and Bangweulu, with their stretches of swampy margin.

I was only once fortunate enough to visit Lake Bangweulu, and then

only saw its southern end. My object was to find the exit or exits of the Luapula river, on which the position of a portion of the Anglo-Congolese boundary depends. It was just after the end of the dry season when I arrived at Chongolo's, on the Luapula. It had been my intention to go in canoes from this point up the river to its exit from the lake, but Captain Bright, of the Buffs, then commandant of the North-Eastern Rhodesia constabulary, who two months before was journeying up the west side of Bangweulu, had, with the help of the native commissioner, collected a fleet of canoes and had succeeded, with much discomfort but no great difficulty, in paddling up this part of the river, and had found

CHIMANABUI RIVER.

the Luapula exit to be, as it was shown on the map, at Panta. Captain Bright kindly sent me his observations for latitudes and time, and his sketch of the river through the Bangweulu swamp, and I was thus at liberty to take a more westerly route on drier land from Chongolo's to the lake.

Approaching Chongolo's from the south-east and east is very gently undulating country, mostly brush-covered on the higher parts, but in the shallow hollows bare and often swampy; near the Luapula it becomes level open plain, dotted with clumps of trees and palms which are nearly always growing on or around an ant-heap. Narrow arms of

the swamp extend into the plain, and pools or little lakes of open water are frequent near the edge. Wildfowl of many sorts abound, and elephants may occasionally be seen wandering safely in their wise way over treacherous ground, which at first sight one would never think could bear them. At Chongolo's the Luapula, flowing due south, emerges from the swamp, and is there a deep stream 150 to 200 yards in width, with a strong current, between steep banks 16 feet in height. The water rises to and perhaps over these banks in the rainy season, but not much over them, for Chongolo's village is built close to the edge, on a small rise which is not more than 2 or 3 feet above the general level of the plain. On leaving the swamp the river turns at once to the west, flowing in low and often swampy ground, but between well-defined banks, and not until past Sakontwi is it kept well within these banks by firm and much higher ground. On the north side of the river, crossing at Chongolo's, bordering on or extending into the swamp, is the same sort of level plain, gradually changing to gentle undulations, the bottoms of which are still mostly swamp, and the higher parts sometimes narrow tongues of bush, which, as the ground rises still higher to the west, merge into the general thin forest of the country. This gradual rise from swamp to forest causes the boundary between dry and flooded lands to fluctuate very much, but the worst of floods would not extend beyond a line drawn from Sakontwi, through Kalasa's, and up the western side of the Musaba swamp, and even then the bulk of the bush-covered country between this swamp and Kampalombo and the whole of Kapata would be high above any water.

My routes from Chongolo's to the lake and back are shown on the map; that on the way up was by Kalasa's, Kawongo's on the Musaba, Kampalombo, and Kapata. Not knowing the country, nor anywhere being able to see far, and being guided in directions which varied only between the limits of north-west and south-east, Bangweulu began then to take on for me a complicated appearance; at the ferries at Kawongo's and Mlakwa's I suspected other connections between Bangweulu and the Luapula besides that at Panta, or that I had struck the lake 25 miles south of that point. I was not at Bangweulu yet, however, but at a large sheet of water, known as Kampalombo, to the south of it, which later I found to be only a backwater from the Luapula, whilst Musaba is a long narrow swamp which drains to it from the comparatively high land lying just to the south-west of the lake. Kapata is the name given to a narrow forest-covered tongue of land, rising to 50 feet in height, which stretches southwards from Bangweulu 20 miles into Kampalombo. At the north end of this tongue is Panta, a point 30 feet above water-level, from which to the west there is a clear view across to Mbawala island, and to the east, over the exit of the Luapula and the vast green swamp beyond to a distant horizon as level as that of the open water to the north.

The outflow from Bangweulu at this point is at its commencement about a mile wide, between well-defined walls of papyrus, but it soon narrows down to less than 300 yards, when there is a very slow current. It keeps a tortuous course on its way south through the swamps, and does not flow into the open water of Kampalombo, though it is joined up with it through the swamp by many canoe-tracks, which, at the time I was there, did not carry enough water (it was said) to float the canoes.

From the Luapula at Panta to Chirui island the swamp on the east

LUKUSYA RIVER.

is of dense papyrus, and there is no stream of water through it either to or from the lake. From Panta to the south-west corner of Bangweulu the bank rises steeply from the swamp fringe of the lake to from 30 feet to 40 feet above it, except at one spot where Kampalombo is only separated by a low sand-ridge, which is not, however, low enough to be crossed by water at any time of the year; at Panta, therefore, is the only exit from the lake. This low sand-ridge is now covered by scanty vegetation, and the northern point of Kampalombo is a narrow swamp

reaching up to it; but when the water-level of Bangweulu was higher, as it undoubtedly has been, Kampalombo was a southern extension of the lake, and Kapata but a low sandy island, as Mbawala now is, lying in the line of a current from the north-east, which then possibly scoured out the steep bank on the south from the thick horizontal sheet of laterite which makes it. The very picturesque little lake at Mano drains into Bangweulu, and is fed by two small streams which come from the higher forest-clad country mentioned as separating it from the head of the Musaba swamp.

The Chambezi does not flow into Bangweulu, but joins the Luapula in the swamp to the south, which accounts for the flood rise of 16 feet or more in the river at Chongolo's, whilst Bangweulu itself does not fluctuate much over 2 feet between its winter and summer levels. The flood-waters of the Chambezi, spread out as they are over a large area of swamp and filtered by its thick vegetation, are surely and not slowly converting the swamp into drier land, whilst the Luapula as surely, but much more slowly, is deepening its course and draining Bangweulu. It has cut its bed now 20 feet below the plain at Chongolo's, and 10 feet of this is through the laterite which formed under the swamp when the exit of the river from the lake was nearer to Sakontwi than to Panta, and the lake and the swamps to the east and north-east covered double or treble the area they do now.

Excepting in the swamps and on a few high hills, nearly the whole of the high lands of North-Eastern Rhodesia are covered with thin forest, which is evergreen even in the driest parts, and it is in the driest time—four or five weeks before rain—that this forest begins to put on new foliage; in fact, breaks out into its most gorgeous colours. It was early in September, before there is, as a rule, any sign of rain, that Thomson, after climbing the Machinga to this plateau, described this foliage as the rich colours of a "dawning spring, gorgeous yet delicate, surpassing anything to be seen in the autumn glories of our own woodlands, or in the flowery splendours of a Moorish summer. Ruby and crimson prevailed, and, massed together, glowed under the tropic sun like a field of living flame."

The forest is at this time said by the natives to be praying for rain, but it is fire, unfortunately, which it often gets, for during the last months of the dry season patches of forest are cleared for new gardens; small trees are cut down, and the upper branches of big ones lopped off, so that only the high stumps are left. The brushwood and leafy branches thus cut are all heaped on the patches which are to be cultivated (only one-fifth to one-tenth of the extent cut down), and there left to dry. Just before the rains these heaps are burned and the ashes and charcoal raked into the soil beneath, and in this as soon as the rains commence the seed is sown. At the time of the burning, though the trees have put on all their new foliage, the grass is still very dry, and

should the fire spread the whole of this foliage is scorched, and the trees are left nearly leafless on parched ground strewn with their charred or shrivelled leaves. It is some time before the trees begin to recover, and then all the foliage comes out on the trunk and main branches, none of it on new wood, and all new growth is destroyed at least for one year, perhaps for more. Fires lighted earlier, when the grass is not so dry and new foliage has not sprouted, would not do so much harm, possibly no harm; but natives will not burn it then, for should the fire spread to their newly cleared ground before the cut and heaped wood is dry, only the dried leaves and small twigs then burn, there is no ash and charcoal to rake into the ground, and no crops can be sown. Not

BRIDGE OVER THE KAFUE RIVER.

only the labour of clearing is lost, but the garden also is lost for the year, for it is too late to begin again. This form of cultivation is mostly employed for growing a small corn called malezi, which can be grown on poor soil, and which is grown much, for it is not only a staple food, but also makes the best of beer.

That the soil is not everywhere rich does not mean that there are no good lands for farming. The country is large, and the extent of suitable farming land makes up, in the aggregate, a very large area. It is well distributed throughout the whole of the highlands, and some areas would carry a large number of farms each with good arable and grazing land. The best areas, or at any rate the most convenient at first, are those in the high lands where there are many small streams, and in the lower land only close along the larger rivers; for where the streams are larger

and not so numerous, the great tracts of forest-covered country between are not suitable for European dwellings, and though they are used by the natives for gardens during the wet season, they are abandoned for want of drinking-water in the dry weather. It is surface water that fails; that there is water not far beneath the surface is shown by the sprouting of the forest long before any rains have fallen, and wherever water has been sunk for it has been found. A few farms have been started near Fife and Abercorn and on the Luapula, but as yet there is no market for agricultural produce; only cattle are being farmed, and these have done extremely well. Some agricultural produce (wheat, potatoes, etc.) has been grown by the various missionary societies whose estates are scattered through the country, and who have many of them done good pioneering work, bringing land under cultivation and building good houses, and teaching the natives such trades as carpentering and building. It is due to their teaching, also, that so many natives can be and are employed in offices as telegraphists and type-writers.

The population on this part of the plateau (north of the Congo-Zambezi watershed) is nowhere dense; it averages over all, according to the latest returns, which are fairly complete, 3·12 per mile. In the west, between the Luapula and Bangweulu it is densest, being 4·23 to the mile; in the north, including the Awemba country, it is 4·0; but it diminishes in the centre to only 2·5, falling in the south-east around Serenje and Mpika to less than 1·0 per mile. The country in these last districts is well watered and as fertile as the rest, the scarcity of population being probably due to old Awemba raids.

The high country in the Congo basin just described comprises two-fifths of the present extent of North-Eastern Rhodesia. That to the south, as already described as being now part of North-Western Rhodesia, is not in appearance very different from that on the north; it too, after the first fall from the ridge, slopes gently to the swampy plains which border the Kafue, or to the edge of the Machinga, which can be considered to end at the Bolengwe gorge, below where the railway crosses the Kafue at a height of over 3200 feet above the sea. The rivers which drain this high land to the Luangwa, like those to Rukwa, fall from it in cascades and waterfalls, or have cut deep gorges back into the Machinga, down which they rush as mountain torrents, to be absorbed or become half-stagnant streams in the hot country below.

One noticeable difference, however, in this southern high land is the prevalence throughout it of crystalline limestones or marble, of which I have not seen a sign north of the ridge.* This has not much effect on the scenery, except perhaps that there are more often open dry plains, and the country generally is not quite so thickly wooded. It is in this limestone near the lesser Kafue river that the peculiar isolated deep

* These limestones occur again, however, on the west side of Tanganyika, in the Congo State.

pools exist, which have been sometimes described, I believe, as the mouths of extinct volcanoes, and sometimes as "old workings." Some are simply deep pools of perfectly clear water, with steep or perpendicular limestone edges surrounded by dense vegetation. They do not lie on any line of surface drainage, and are probably the result of falling in of caves in the limestone below. The most remarkable one I saw was one called Chirengwa, just north of Chiwala's, on the lesser Kafue; it is a sudden, nearly square depression 250 yards across, near the crest of a gentle undulation in bush-covered country. The forest grows up to the edge of the depression and extends down the sides, which slope at an angle varying from 31° to 48° and fall 150 feet to the water, which in this case is not very clear nor deep, and is on a muddy bottom. The rock outcropping on the sides near the water is a light-coloured sandy shale or schist steeply dipping to the north-east. The schist is the same as that often accompanying the crystalline limestones, which here lie beneath it, and outcrop in the Kafue with a dip of 60° in the same direction. There is nothing to indicate how the depression was caused, and the sides are weathered to *débris*, which covers all but a few small outcrops of the rock. There is no sign of igneous rock anywhere near, nor are there any heaps of excavated material, and this, like the other pools, is probably also the result of a fallen-in cave. It is reported to be the home of that mythical animal the chibekwe, or water-rhinoceros, which lives in such secluded places and in deep lakes, has apparently the peculiarity of leaving no spoor, and whose daily food is a big hippopotamus. Mr. Neave told me of another of these pools which he had visited; it had steep limestone sides, the water was very clear and cold, and rose to near the ground-level; it was very deep, and though he sounded 300 feet, he did not find the bottom, nor did he, I believe, meet with the chibekwe.

It is amongst these limestones that the rich mines of copper, zinc, and lead are found, many of which have been worked some time in the past, some only on the surface, but others deeper, galleries having been found 100 feet deep (in the Bwana M'Kubwa); but, as in the old workings elsewhere in Rhodesia, nothing has yet been found which determines the time at which these workings were carried on.

The railway from the Cape is now at Broken hill, the first of these mines of lead and zinc. Its continuation will take it past the Bwana M'Kubwa copper-mine and other large mining properties to the Congo border, where it will not be far from the Katanga country, probably one of the richest mineralized areas known. The effect of the railway on this part of the country should be very great, for it passes through much level alluvial plain, well suited for agriculture, and the mines are even now a very ready market. There is room for many farms along the railway, and not far from the mines; perhaps even for small farms, which are not generally considered possible in South Africa. At

Kalomo, in North-West Rhodesia, I saw one farm where the owner, experienced in the United States as well as in South Africa, had, with the help of but little agricultural machinery, put 800 acres under corn this year, and though it is too early yet to boast, he was very confident of success.

This part of the high land (between the Kafue river and the Congo-Zambezi watershed) is thinly populated, the density being only 1·6 per mile, exactly why is difficult to see. There are, it is true, large scantily watered areas in it, and possibly it gets on the whole a smaller rainfall, but there are also large areas along rivers with abundant water all the year round, where very few people live. Where the population has settled they get good crops, and have been able to sell large quantities of food to the mines, but of cattle there are almost none.

Over the whole of the plateau game of all sorts is fairly abundant, and is very much on the increase; the natives have now no guns, and of the Europeans who live most amongst the game few shoot more than they need for food, or for a good head or trophy. Wise game laws, making the purchase of licences necessary to all those desiring to shoot, both officials and others, and limiting the numbers to be shot, also tend to this desirable result. The desire to kill or make a big bag does not last very long with those who often must kill to keep their carriers in food, or at least in good temper by a change of diet from the monotony of only corn; and to do this is not unimportant when a white man has to travel for weeks with the same carriers, whose principal inducement, and perhaps only pleasure, in keeping with him is often the change to a meat diet. The hippopotamus is found in most of the larger streams, and as his carcase is enormous and the meat good, it is not unseldom sought for this purpose, and though a dead hippopotamus may mean at least a day's delay whilst the meat is being cut up and dried, the killing does not necessitate much deviation from the route, and almost never the following of a wounded beast. Elephants are plentiful in the west and centre of the plateau, but are also found in small herds almost everywhere. Shooting them is not such an easy matter, for, except with extraordinary luck, the time and labour needed to get up to them are too much for a man on an ordinary journey, from which he is not prepared to deviate far; and sometimes, if he would not leave a wounded animal, it means toiling for days far from his route and in any direction but that he wishes to travel. All of the Europeans in the country are employed on some work or other, and can seldom give up the time on their journeys for such amusement, however great the temptation of the chase of a big bull elephant, with a pair of good tusks as a trophy; and unless full time can be given, a chase begun mostly ends in the late return of the disappointed hunter, weary and tired to stumbling, with every inequality of the ground a stumbling-block, and every tuft of grass a trap, still far from the carriers and the camp

VIEW FROM MUCHINGA MOUNTAINS, NEAR MIRONGO.

he left earlier in the day, of whose whereabouts now he has no sure idea.

The rhinoceros is much less common, and, though it is found in many parts of the plateau, does not wander so far as the elephant, and is not often seen except in the patches of country it is well known to haunt. Buffaloes, also, are increasing, though there are no large herds; to them and to the rhinoceros the natives often attribute the spread of the tse-tse fly. Eland, roan, and hartebeeste are met with everywhere, but kudu and sable are more confined to special areas; the sasabe and lechwe are found in the larger swampy places, and the sititunga in many swamps, but the sportsman must be up very early to see one. The puku is the commonest of the smallest antelopes, but waterbuck, bushbuck, reedbuck, oribi, and impala are all met with, in places plentifully, and the duiker is everywhere.

The low lands of North-Eastern Rhodesia are included in the Luangwa valley; the contrast between these and the high country is very great, and the change from one to the other is very sudden, there being but little intermediate ground, and, as if to emphasize the contrast, this valley, which is deep from its commencement, starts from near the Nyika plateau, 8500 feet above the sea, the highest land in the country, amidst patches of heavy virgin forest, plentifully watered and occasionally snowed upon. From this small plateau springs the high spur which separates the Luangwa valley from Nyasa, and, continuing south as still a high range, dies down only between the Shiré and Zambezi rivers. This spur is on its Nyasa slope fairly well watered, but on the Luangwa side, from the Nyika plateau to Tete, there is no river except the Luumbu (rising in the plateau itself), which in the winter (dry) season does not dry up before it reaches the Luangwa or the Zambezi, and most of them are dry from their sources. Rain fails constantly on this western slope, especially towards the Zambezi, and food is every year scarce, often to the extent of famine. This ridge has a great effect on the Luangwa valley, which, shut in by high hills on both sides, is very hot, and more typically tropical than the high lands, but tropical in its heat more than in a constant luxuriance of vegetation; for though in the rainy season, with full and overflowing rivers and a steamy atmosphere, the vegetation would vie in luxuriance with that of any other part of the world, yet the long dry season completely alters its appearance. The south-east winds that blow across it arrive desiccated by the ridge they have crossed on their way, and, getting warm in the valley, are thirsty to take away what moisture they can find to the hills again on the far side. The streams from the steep hillsides soon run off their supply of water, those on the left bank, as already said, all dry up, and those from the Machinga become most of them at best but a chain of stagnant pools soon after they reach the plain. In the great heat the trees drop all their leaves, and over large areas grass fires leave the ground bare as well as shade-

less, and the Luangwa itself then dwindles to a comparatively small stream meandering in a wide sandy bed, which in places, where the hills come close to the river, is used as the easiest road through the country.

Two interesting features of part of this country Mr. Beringer mentions. The first is the peculiar watershed formation of Lake Nyasa and the Luangwa river between lats. 11° and 12° 15′. For a distance of nearly 90 miles the Kukuru river runs generally not more than from a quarter to 3 miles away from this watershed. The country between, except for a few isolated hills, is very flat. On the other hand, the country to the east, in British Central Africa, is very mountainous

VIEW FROM ILONDA HILL, TANGANYIKA.

and higher than the watershed; consequently, whilst the Kukuru river is plentifully supplied with water into its right bank, the left bank and the entire country between it and the Luangwa river, within the above latitudes, is for the greater part of the year waterless. Directly to the west of this watershed the country is very broken, and falls more or less steeply into the Luangwa valley some 2000 feet below. The other interesting feature is, that in many places within a few miles north and south of 11° 30′ lat. the land is crumbling and falling away into the Luangwa valley to such an extent that in a comparatively short time it will have reached and drained a large stretch of the upper waters of the Kukuru river into the Luangwa. A very shallow and short cutting would anticipate this now.

But though the Luangwa valley is unpleasantly hot to one accustomed to the higher lands, it has its riches and attractions. It is the

home of the biggest of big game—the elephant, rhinoceros, hippopotamus, buffalo, and lion are to be found in most parts of it; the few giraffes left in the country are there (they have a large reserve set aside for them). Eland, wildebeeste, roan, sable, kudu, and many of the smaller antelopes are each of them fairly plentiful in some part of the valley, and the sportsman or naturalist who has no need to push on a day's journey each day can always find shaded and pleasant, if somewhat warm, camping-grounds near some pool on higher land away from the beaten track.

But not for sport only is the country good; its rich cotton soil is probably its best recommendation. The natives of the valley have always grown cotton, and still grow it in small quantities, and the British South Africa Company have for some little time had experimental plantations on which foreign as well as native cotton seeds have been tried with great success. The deep black soil of much of the valley is said by Mr. de Josselin de Jong, the Superintendent of Agriculture, to be "an ideal soil for cotton, and the cotton bushes of the natives, who have a very simple mode of cultivation, bear good crops for many years; they never cut down their trees, and seldom root them up to plant new ones. A little hoeing round the trees," he says, "is the only sign of cultivation, and the growing power of the bushes and the continuous good crops speak much for the soil and the suitability of the Luangwa valley." Samples of native cotton sent home were valued at from 7*d.* to 8*d.* per pound, some of it from almost uncultivated trees seven years old.

The Luangwa valley is over 400 miles long, and for at least 250 miles of this it is bordered by alluvial plain, much of it of red unsuitable ground, but still much of it of black "ideal soil," and it is to be hoped that it may yet be utilized for the purpose for which it seems so fitted. In this valley, as indeed over much of the country, the Sanseveiria fibre grows plentifully, but scattered too much over large areas to make its systematic collection profitable. The fibre is valuable and easily cultivated, and with cotton and the bye-products of cotton (oil and oil-cake), together they may make this valley worth much in time, to the benefit of the people and much to the regret of the sportsman; for the tse-tse fly is abundant and cannot be exterminated, so that the game must be killed off sometime before the domestic animals necessary for agriculture can be moved in from the places still free from "fly."

It is in this valley, also, that there are some extensive forests of useful timber—the mopani tree, which grows in low land in open forest with but little undergrowth. The forests near the Luangwa are often almost entirely composed of this tree, which grows with a straight stem, and throws out no spreading branches; the wood is dark and hard, and good for all building purposes, for white ants will not touch it, and will be very valuable for mining timber.

Within the valley, but distinct from it, is one small piece of country, around Fort Jameson and eastwards, which, ranging in height from 3000 to 4000 feet, resembles almost the country of the plateau. It is near the Luangwa-Nyasa watershed, where this is widened out by the spur which divides the Luangwa from the Zambezi. The watershed here is on the highest land, unlike that to the north, where still higher hills lie between it and Lake Nyasa. It is not, therefore, here robbed of so much of its rain, with the result that it is both fertile and thickly populated. The difference, however, between the eastern and western slopes is still very great, and, whereas on the east, good-sized rivers run down to the lake, on the west the streams do not in dry weather carry water many miles from their sources. It receives an annual rainfall of 39 inches, of which over 37 fall in the five months from November to March, and the south-east winds blow for five out of the

SOUTH END OF LAKE TANGANYIKA.

other seven months almost absolutely dry. It is in this part of the country that a portion of the Zulu armies (now calling themselves the Angoni) settled after their migration from the south, bringing with them southern cattle, and soon making themselves masters of the country. It is a good cattle country, and still has more cattle and is more densely populated than any other part of North-Eastern Rhodesia. It carries ten people to the mile over an area of 5000 square miles, while the rest of the Luangwa valley averages only 2·2, and in none of its divisions rises to 3·0.

In the whole country, including the plateau and that between the Luangwa and the Kafue rivers, the population hardly reaches or only just passes 400,000 souls, an average of 2·6 per mile.

Both of my visits to the country were made principally with the idea of seeing and shooting in what was much of it new country; but wandering and shooting, even in new and interesting country, are in themselves but poor amusement for more than a limited time, and I spent much of mine on all my journeys in astronomically mapping my routes, and added to the pleasure of simple tramp and sport the interest of seeing the country's shape and structure gradually develop on paper. But the country is big, the means of locomotion slow, and the interests of shooting and of mapping were often greatly opposed, so that the progress on the map was lamentably small. In this manner, however, I had mapped about 3000 miles of route—some of the routes two or more times, and many crossing one another or touching at not very distant intervals —when I was fortunate enough to join the British South Africa Company, to start and take charge of their Survey Department in North-Eastern Rhodesia. All the work I had done became then of immediate use, and, with that which soon followed from able and willing assistants, helped to make the groundwork of the present map, of which now my work is very much the smaller part.

The Survey Department could not give much of its time to mapping only, for its first work was the survey of farms and townships and small areas, which together add but little to the map. By utilizing, however, all surveyed routes, and continuing to survey the route of every journey made by a surveyor, a skeleton map is growing, on which all surveys of isolated farms, and plane-table surveys of larger areas, can be placed in their respective positions, and for further filling in, till better survey is done, the routes and sketch-maps made by magistrates and native commissioners between known points on the skeleton can be utilized. Absolute longitude is taken from the beacons at Fife and Mambwe, on the Anglo-German border, and at Fort Jameson, which I was enabled to fix by signals from Cape Town Observatory. At present there are over 5000 miles of astronomically surveyed routes, all connected with one another and with these fixed points, and on them the principal stations have been fixed fairly closely in latitude and in time, and other points

have been determined in the same manner every 12 to 18 miles, the road between being filled in by compass bearings and sketches. An accurate trigonometrical survey of the country cannot be hoped for for very many years, but on such a network of surveyed routes the general features of the country can be shown with not much distortion, and as more and more survey gradually takes the place of sketches, it should form a constantly improving map, which will be of general use until one based on more accurate triangulation can be made.

SOUTH END OF LAKE BANGWEULU.

The map is being plotted on a scale of 1 : 250,000, but as on this only the routes and actual surveys are plotted, there are too many blank spaces and even blank sheets for the map to be of any public interest; a smaller map therefore, on a scale of 1 : 1,000,000, has been prepared. It is based on the same information as the large map, but Mr. Beringer, who made some of the surveyed routes and most of the plane-table survey in the country, has, with infinite labour, incorporated with this all the information given on the many scores of sketches and route and compass surveys made by the various district officials, often only isolated small sketches

which the surveyed routes have enabled him to locate and orient, and descriptions and aneroid readings which have guided him in showing on his map the general contours of the country.

Accompanying the map is a smaller one, showing in black lines the network of routes on which it is founded, and the areas which have been surveyed. The heavier lines are all astronomically surveyed routes; the thinner lines are routes on which only latitudes were taken. The meshes in the net are very unequal in size, and some as yet are very large, but the large number of compass sketches and surveys of many of the district officials have enabled these gaps to be filled in with, it is believed, such a near approach to truth as to make the map of real use until better survey can be substituted. On the southern border the plane-table survey is partly taken from work done by the Anglo-Portuguese Boundary Commission; the eastern boundary was all plane-tabled by Mr. Beringer, starting from measured bases in and near Fort Jameson, and checked on the way by observations for latitude and azimuth, and again on the beacons of the Anglo-German boundary, which were thus connected with those on the southern border.

On the north, the map of the Boundary Commission is used, augmented by work done by Mr. Beringer, both in the trigonometrical survey of farms and by plane-table. A little plane-tabling has also been done on the new boundary between North-Eastern and North-Western Rhodesia, and over a small area round Fort Jameson. This plane-table work has always been done with astronomical checks, but always, also, on the principle that it was more useful at present to spend time in getting a fairly true survey of a large tract of country than to use it in accurate survey of the details of much more limited areas. From the above description of what the map is based on, it will be understood that it does not claim to be all surveyed, and from the accompanying key map the relative accuracy of the different parts of it can be estimated, and may be a guide to others, as it is to us, what parts of it we may and what may not alter in adjusting new routes or sketches to it.

Unfortunately, none of the work of the Geodetic Survey has come in time to be incorporated in the map. This survey was started in the beginning of 1903, the Chartered Company having decided to continue it for three years, under the direction of Sir David Gill, believing that in time it would reach Tanganyika. Though Dr. Rubin, who was engaged by Sir David Gill to take charge of the work, arrived in the country early in 1903, work on the survey did not begin until the next year, for unfortunately (for the Geodetic Survey) he was employed for the greater part of the first year in delimiting the Anglo-Portuguese frontier south of the Zambezi, the opportunity of his presence there being taken to mark off the true meridian which at this point forms the boundary. A second misfortune was that the years 1903–4 were years of drought and

great scarcity of food, in places of real famine, in that part of the Zambezi valley, and there were consequently many delays caused by the difficulties in organizing the transport and food necessary, and even in providing water where stations had to be occupied for weeks, miles from any stream or pool. The very dense haze which settles over the country often interrupted work, and it was not till October, 1904, that Dr. Rubin and his assistants were well north of the Zambezi and employed on the measurement of a base-line in the Luangwa valley. Up to May, 1905, the survey had covered two degrees of latitude out of the eight necessary to reach Tanganyika. The three years allowed are now over, and the Geodetic Survey will be again interrupted for some time. About half of the field work has been done, and it is to be hoped that, on account of its great interest, means may be found to continue it soon.

GEOLOGY.

In a country without a map it is not often easy to recognize at once the geological structure in any but its most obvious features; when the first routes made through it are plotted on an otherwise blank sheet of map they are but lines widely separated, and as they are often for days over alluvial plain where notes are of necessity few, or in bush where vision is very limited, and information gathered seems so little on the widely separated lines and so often without any apparent connection—all the notes of months of travelling when placed on these beginnings of a map seem hopelessly useless. But as the number of journeys goes on increasing, the old notes begin to be more intelligible, and new ones convey a fuller meaning, or at least are open to a more immediate interpretation, and some form begins to show. The gaps between my routes are still very large; some too large for even a guess at their structure, others so surrounded by notes that it is not unsafe to come to conclusions about what rocks they contain. It is from this state of many routes with many large gaps and omissions that the following description of the geology of the country is given. In giving it, I will commence with the country of the Zambezi valley just outside of Rhodesia, on the south-east, passing on to the north-westward across the Luangwa and along the Machinga hills on the west of this river, then westward to Tanganyika and Mweru, turning thence south again through Bangweulu to the river Kafue, and I will leave to the last the description of the Luangwa valley.

Commencing, then, with the country between the Zambezi and Luangwa rivers and the Zambezi-Nyasa watershed as far north as 13° lat. This part of the country is nearly all granite, and many of the hills are typical granite bosses, some of them quite inaccessible and standing out 2000 feet above the surrounding country. Over the granite are scattered a few small areas of quartz- and mica-schists, which are but the comparatively small remnants of the Archæan rocks into which the granite was intrusive. These schists stand in almost vertical strata, sometimes amongst the hollows between the bare granite mountains; and often, as at Fort Jameson, they form only the tops of the hills in small and isolated patches. My routes over this country were from the Luangwa at lat. 12° 30′, through Fort Jameson to the Zambezi at Tete, and from the Anglo-Portuguese boundary along lat. 14° to the Luangwa, and again from Fort Jameson to the Luangwa

on a route 30 miles to the north of this; and these routes are almost entirely on only granite, which, however, is often distinctly foliated over large areas, graduating from a granitoid to a foliated structure, and passing at times into a coarse-grained gneiss, interbedded occasionally with the schists where these are found on the granite.

The Zambezi at Tete flows over a soft horizontal sandstone, which will be noticed later, but a few miles up-stream it comes through hills of interstratified and nearly vertical schists and gneisses, with which is a single stratum of coarsely crystalline limestone stained occasionally with malachite; their strike is across the river to the north-east, but it turns in 10 miles to the north. A little further up-stream the Kabrabasa rapids come over granite, which extends up the river many miles; I have not seen how far. From here in a north-westerly direction for 170 miles is granite, and granite only, to Sasare, where are again some nearly vertical gneisses and quartz- and mica-schists highly impregnated with copper, all with a general strike about north-north-east. Again amongst them is a stratum of coarsely crystalline limestone, which can be traced at intervals for 50 miles, and 60 miles further to the north-east a similar stratum (or perhaps the same, but here it is dolomitic) occurs interbedded with gneiss with the same steep dip and strike to the north-east, but with no quartz-schists. This strip of schists at Sasare is not on the edge of the granite, for across these, 2 or 3 miles to the north-west, is again granite, which extends beyond the Luangwa to the Machinga. It would seem that these Archæan schists were lying in folds with a north-east and south-west direction when the granite was forced into them, since when, at least over this area, they have nearly disappeared.

Crossing now to the western side of the Luangwa river, granite and much more abundant schists make up the whole of the Machinga range from the Lusenfwa river north-eastwards to beyond Mirongo. The schists, amongst which quartzites and quartz-schists are much the greater part, dip always at very steep angles, which vary even in the same stratum from side to side, and are always nearly vertical; they have a general strike north-eastwards, with occasional sudden variations to a direction at right angles to this. On the plateau above they show with the same strike and sudden contortions over a strip of country parallel with the range, and varying in width from 20 to 40 miles measured back from the edge of the Machinga. Their outcrop, striking north-east and alternating with granite, is seen along the road as far west as Mkushi, and again halfway between Serenje and Sakontwi, with a strike to the north, and as, crossing them there, the dip varies in a very few miles from east to west, it probably shows a steep anticlinal fold. On this high ground the rocks are much covered by alluvial soil and disintegrated rock, but they show in the hills and in many streams occasionally as walls of rock running across the centre, and often as lines of vertical wind-worn slabs which have almost an artificial appearance of regularity.

They vary from soft micaceous sandstone to brittle laminated quartzite which seems to weather to itacolumnite, and some are sugary quartzites which when weathered are on the surface a loose white sandstone, but when broken are at the core an almost translucent bluish glass-like quartz or an aggregate of transparent crystalline quartz grains from very minute to nearly the size of peas; the more weathered rocks often containing large cubes of limonite, pseudomorphs after pyrites, which still show clearly on their faces the striations of the original crystals. Amongst the softer rocks are mica-schists and phyllites, and some soft argillaceous rocks studded with what once were crystals, but all so decayed and altered now that it is impossible to name them off-hand. Granite is very much mixed up with the schists, and in the steep rise of the Machinga sometimes is exposed

only at the foot of the range, and as often forms the whole rise from bottom to top. On the high land back from the range it constantly appears through the schists, either as bold hills or as low flat domes rising only a few feet above the grass, and a little north of Mirongo it entirely takes the place of the schists, and, with some few schistose rocks of igneous origin near Fife, is the only rock from there westward along the Anglo-German boundary until within a few miles of Abercorn.

At Abercorn and westward, nearly if not quite to Mweru, are the Tanganyika sandstones, which face the south end of Tanganyika in cliffs and steep slopes, altogether amounting to over 3000 feet in thickness. They are generally a coarse red or grey sandy rock, with very few thin strata of shale, and are traversed in places by dark igneous dykes. Near the southernmost part of the lake the lowest exposed strata are very micaceous and laminar, and jointed into small roughly square blocks which weather and decay easily, and there and at Sumbu further west there are some signs of igneous rock (quartz felsites); and from a point a little northwards from Sumbu, on the Anglo-Congolese border, specimens of a red granite have been sent to me. Coming back now to a point about 6 miles eastwards from Abercorn, and over 3000 feet above the lake, there is a small escarpment facing south-east, down which the road falls some 200 feet, and the swamp at the foot of this is lying on crushed quartz-porphyry, which shows for the next 2 or 3 miles; then further on near the Kawimbi Mission is a high sandstone hill, on the far side of which the granites begin, and, as already said, extend all the way to beyond Fife.

From this junction with the granite the sandstones continue in a line about south-south-east to where the Lufubu joins the Chambezi river, and granite shows occasionally close up to them on the east. They end at the Chambezi river, across which are the schists of the Machinga. Following down the Chambezi river to its junction with the Mansya, and from there north-west to Mweru, the route is over the same sandstones. How far they extend south and west of this last line I do not know, for I have not been in that part of the country. Within this area (Tanganyika, Chambezi, and Mweru) they lie in easy undulations of about 12°, deeply cut into by numerous rivers and streams, and by them exposed in cliffs often hundreds of feet high, and, at least near their eastern and southern limits, the granite they lie on shows in the beds of some of these streams 2000 feet above the level of their lowest strata at Tanganyika.

Southwards from this sandstone area, and west of the Machinga schists, is the Bangweulu country covered with alluvium and swamp, and from the very little I have seen of it I can only guess at its more recent geological history. The Luapula at Sakontwi flows over a soft micaceous and rather muddy horizontal sandstone, which may be connected with the Tanganyika sandstones, but it is very unlike them, and without some knowledge of the country to the west it would be impossible to say. This rock may be connected with some soft horizontal sandstones in the Lukulu and Mansya rivers, near where they flow into the Chambezi, in which case they might well be recent lake deposits. I found, however, no remains in them of the lake life, and there is much that should leave its traces—oysters, for example, which now exist in the Chambezi and grow to a very large size.*

That Bangweulu has covered a much larger area eastward and up the Lukulu, Chambezi, and Mansya rivers goes almost without saying (the contour-map shows how little difference in height would be needed for this), for the rivers that pour

* These oysters are called ngiri by the natives, and are eaten by them.

in on its north and east sides have been piling mud on its shallow bed for centuries, and extending their deltas into it. That it has been higher than now there is evidence on its southern shore in the mud deposits and sheets of laterite, below which now the Luapula has cut its bed.

Not only here, but all over the country, this rock (laterite) is met with lying on or near the surface in a horizontal or nearly horizontal stratum; it varies much in hardness and structure, but its general appearance as a level sheet of rock with a dark brown and very rough surface is always the same. It consists generally of sand and even mould cemented together by iron oxide, and contains numerous cavities and channels lined more or less thickly with limonite. In places it takes on a pisolitic structure, the oxide forming round grains of sand or organic matter as a nucleus, and it is this form which weathers to the small round gravel so common on many native paths. Sometimes the lining of the cavities and channels is so thick, and they and the rock generally contain so much earthy oxide that large fragments have a specific gravity of 3·5. When broken up and picked over, this is the ore used by many of the native smelters of iron.

The rock is found everywhere in flat country, and even in any small area of flat or hollow ground. It shows round the sides and forms the bottom often of the damp open glades in the bush, where the soil that covers it is too thin for trees, and sometimes even for grass, in which case the rock soon becomes exposed in bare level patches; it forms the level plains bordering many of the streams and rivers, which now have cut through it to the clay or rock below, and have exposed a stratum sometimes over 10 feet thick, throughout which are embedded angular fragments, and, where the hills fall steeply to the edge of the plain, even large boulders of the country rock. From its constant mode of occurrence, it is easily seen that it has formed under swamps, or at least under very wet ground, and is still forming in almost every swamp in the country. On examining the mud and clay in the swamps, or where the natives have sunk in damp ground to get the softer ore for smelting, it is soon seen how like this mud, where it has hardened, often is to the softer laterites poor in iron; and where roots have rotted out and their tunnels are left, they often already show the harder lining of iron-stained material. Sometimes the dead root or small tuber is there, but more often the cavity is filled with mud or sand.

Along the same stream can often be seen, in one place a swamp with soft laterite under it, and the harder rock showing in the drier grass and bush which border it; in another place, where the obstacle which once kept back the water has been gradually worn away, the swamp above it has dried and become a slightly hollow grass plain, sometimes invaded by bush, but more often, denuded of its soil, it forms one of the many examples of a bare sheet of hardened laterite sloping gently to the edge of the stream, which has now cut its bed down deep below it. It is one of these thick sheets covered with soil that shows on the bank of the Luapula at Chongolo's, and in the steep southern bank of Bangweulu, in dry land 20 feet above the present water-level. Knowing its common mode of occurrence, it is impossible to see it there and in the Luapula and Luombwa rivers without coming to the conclusion that it formed under what was the Bangweulu swamp when these rivers were flowing at a much higher level.

Leaving Bangweulu and continuing further south to the country between the Congo-Zambezi watershed and the Kafue river and still keeping to the west of the Machinga schists,* an entirely different set of rocks is met with, principally white and grey marble and mica- and quartz-schists. They are separated from the Machinga schists by a strip, 50 miles wide, of granite, which is the only rock showing, and that most abundantly, on the road between Mwushi and Mwomboshi.

West of Mwomboshi to beyond Sitanda, northwards to Chiwala's, and southwards to 40 or 50 miles beyond the Kafue river, these crystalline limestones and schists are lying in steep folds with a general east-and-west strike. Granite shows through them in some low hills between Mwomboshi and Kafue, and again near Sitanda; but the actual contact is not visible, for the country is not very hilly, and is covered by much soil, so that one may travel for 40 or 50 miles at a time and not see a sign of a rock, unless he has the time to deviate as he will from the route. The marbles vary in texture from fine to very coarsely crystalline, and in colour from white to very dark grey; they are in places very richly mineralized with copper, lead, zinc, and iron, the Broken Hill mine consisting of two small hills, one almost entirely of zinc, and the other of lead ore; and near the Kafue river is a fine hill of nothing but black, nearly pure hematite rock, finely crystalline throughout, and often very micaceous. Other mines are of copper, occurring mostly as huge pockets of sulphide, but the Bwana Mkubwa mine is said to be a true lode. There are many quartz reef outcrops, of which one found lately is believed to be very rich in gold, though this has yet to be proved. Some gold there is, but, except perhaps in this new reef, it has not been found in payable quantities.

Thus far the description has embraced first the granite country between the Zambezi and Luangwa rivers from Tete through Fort Jameson to lat. 13°; then, crossing the Luangwa on lat. 15°, it goes from the Lusenfwa river north-eastwards along the Machinga schists as a wide strip up to lat. 10°, where it comes to the granites again on the north, and passes eastward from these to the Tanganyika sandstones; then, turning southwards, it comes through the Bangweulu country and over the Congo-Zambezi watershed to the high land between this and the Kafue river. There remain to be described the Luangwa valley and the ridge between it and Lake Nyasa.

The spur between the Luangwa and Nyasa, north of Fort Jameson, is, like the country to the south of that place, mostly granite, with some Archæan schists up to as far north as Mount Waller, and after this, near the lake, are granite and schists again. Between Mount Waller and Fort Hill over the Nyika plateau is probably one of the most interesting parts geologically in North-Eastern Rhodesia, for there are to be seen the old schists and granite, the Mount Waller sandstones, Drummond's beds, which Mr. Moore says lie unconformably on them, and a series of other rocks, remnants of which show in the Luangwa valley and on the Lusenfwa and Lukashashi rivers, and again near the Zambezi as far down as Tete. I have made but one too short trip into this country, from Mirongo across the Luangwa to Katumbi's on the Luumbu river, and so only touched the southern edge of it. Between the Luangwa and Luumbu rivers near Katumbi's is a ridge of hills 1500 feet in height at this place, but rising higher further north. At their base in the Luumbu river are grey, compact, and somewhat sandy limestones, which on fracture show a sheen of reflected light from minute crystallization. Above these limestones, and at first sight almost indistinguishable from them, is a very fine ripple-marked grey sandstone, almost a shale, which is followed by a coarse, gritty arkose, and this by pinkish sandstones containing occasional very hard, compact, calcareous patches, which weather out of the rock and break with an almost conchoidal fracture; on the top are fine pink ripple-marked sandstones, which, like the limestone at the base, have a dip of 10° to the north-west.

Across the Luumbu river, that is eastward, and in places showing in its bed, are granite gneiss and schists, which extend to the Nyasa watershed, and separate these sandstones at this point (I have not seen further north) from those at Mount Waller. I do not know the Mount Waller rocks, but these Luumbu strata do not correspond with the description of them, and they are altogether unlike the

Tanganyika sandstones, which, as far as I have been able to see or hear, contain no lime whatever. From the foot of these sandstone hills westward on the lowland towards the Luangwa are thin strata of light grey limestone and fine grey shale-like sandstones, and above them a soft, rather coarse sandstone containing angular fragments of felspar, the ground over them being covered with water-worn pebbles of quartzite. Near the Luangwa is the alluvial deposit in which the river flows, and across this the first rock met with is granite, on which are the Machinga schists; lying against these, in a deep hollow 200 to 300 feet above the river, is a bed of hard conglomerate, with quartzite pebbles, which, though I did not see the limestone there nor the conglomerate at Luumbu, lies, as I saw later, in patches above the limestone. These thin strata of lime and sandstone in the low land east of the Luangwa have the same dip and strike as those in the Luumbu; but there is probably much faulting * between, and they are the same as the rather thicker beds at the base of the hills there. Except in their thickness, they are indistinguishable from them, and the coarse sandstone, with felspar fragments, represents the arkose of the Luumbu, so that all the other strata which lay above them have here disappeared.

Travelling now down the Luangwa valley, it will be remembered that the hills (the Machinga) on the right are granite and schists; on the left, granite and gneiss and schists, which are possibly older than those of the Machinga. The low land between is principally deep alluvial soil, but occasionally spurs run out into it as far as the river, and the river at times meanders near in to the hills. At the base of these low foothills, in the streams which have cut through them to the main river, are constantly to be seen the thin strata of grey limestone, overlain by coarse gritty sandstone, which again is occasionally arkose; and the ground above them is almost always strewn with well-rounded pebbles of quartzite. A little higher up these hills, in the more protected gulleys, are patches of horizontal strata of sandstones, generally red, which reach in places 500 feet above the river, and lie on the schists or directly on the granite; the base of a stratum is often a conglomerate changing to sandstone, to be conglomerate again at the bottom of the next. In some places these sandstones are but small remnants clinging to the hillside; at others, where the cross-valleys are wider and shallow, they show far from the foothills, and cover an area of a few miles; but more than 500 feet above the river I have not come across them, though if they were deposited here to the thickness they exist at the Luumbu, they should be found 1000 feet higher, and would not then reach within 1200 feet of the top of the Machinga. Continuing down the river, the same phenomena show—pebble-covered plains, with the certainty almost of the grey limestone beneath, and occasionally harder sandstones on the hillsides—until at 14½° S. lat. the hills close in on the river and form a rather narrow passage, in which no rocks but gneiss and schists are seen. Further down, when the valley broadens out again at the Lusenfwa, and up this and the Mlembo and Lukashashi rivers, still on low ground, the same sandstone and limestone again appear, but in much greater abundance, with the same pebble-covered areas, and with much silicified wood. At the Zambezi, above Feira, I hear are the same rocks; I have not had a chance yet to see. Crossing over from the Lusenfwa westwards towards Tete, I found occasional fragments of the same grey limestone, not much above the Zambezi; and at Tete, as has already been said, the Zambezi flows over a coarse

* I measured the dip at six well-exposed outcrops over a distance of 15 miles, going south-eastwards to the Luumbu, as 15°, 25°, 15°, 12°, 10°, and 10°, with a south-west strike turning to south. Without faulting, a dip of 15° over the distance would give a thickness of over 20,000 feet.

gritty sandstone, which is indistinguishable from that in the Luangwa. Near the sandstones, coal has been found at Tete; it is known near Mount Waller and further north on the Songwe; lately I am told it has been discovered in the Luumbu. It exists in the Lukashashi and Lusenfwa rivers, and there can be little doubt that the sandstones with it are those which contain the coal-seams south of the Zambezi, with some of the Forest sandstones above them; and in the deep valley of the Luangwa they seem to have been deposited when this was a narrow arm of the sea or lake in which all these strata were laid down, and the valley has now been a second time eroded. Among these rocks are none of the interbedded lavas of the forest sandstones of the south, but there are in the Luangwa many copious hot springs, the water issuing at a temperature of 178° to 183°, and having in solution silica and the sulphates of both lime and soda.

Taking a general view of the foregoing sketch, it will be seen that the eastern half of the country is formed of granite and schists, the granite on the east and north being bare, or only occasionally covered by remnants of the schists, while these schists further west are much more abundant, with the granite constantly showing through them. Running through the middle of this area, from north-east to south-west,* is the deep narrow valley of the Luangwa, at the head of which, in the highest land in the country, are the Mount Waller sandstones and the coal-measures of Southern Rhodesia (possibly these are identical) of Permian age; on lower ground lying unconformably † on these are Drummond's Triassic beds; and all down the valley are the remains of more recent rocks, the Forest sandstones, which in the low Zambezi valley overlie the coal-measures and extend into the very high land of Southern Rhodesia.

In the western half of the country are seen—first, in the high land to the north-west, a large area covered by the Tanganyika sandstone in places up to 3000 feet thick, without coal and without lime, separated by nearly 100 miles of granite and schists from the sandstones of the Luumbu, and in what way related to them is yet to be ascertained; next, in the south-east an area of crystalline limestones, much folded, and isolated from the rocks of the east by 50 miles of granite, and bordered apparently on the south by the mass of granite which passes through Kalomo, in North-Western Rhodesia, so that if they are not entirely surrounded by granite, their relation to the other rocks of the country must be found by tracing them round to the west.

Before the paper, the PRESIDENT said: Mr. Wallace, who prepared the paper to be read to-night, is not here; he is in Africa still at his post. He is not unknown to our Society, because some years ago he contributed a very excellent paper on the same region of the world that will be discussed to-night—the Tanganyika plateau. I would especially draw attention to the fact that he for the first time explored Lake Rukwa. Sir Harry Johnston and two or three other explorers had visited Lake Rukwa, but had not explored it. Mr. Wallace at that time was visiting the country for the purposes of shooting and travelling generally. Since then he has become chief surveyor to the British South Africa Company in North-Eastern Rhodesia, and in the performance of his duties he has travelled over this plateau and the surrounding country. The paper will be read by Mr. Otto Beringer, who is

* This is the general strike of all the strata, and it may be noticed that the continuation of the line of the Luangwa valley goes straight up the Zambezi to Wankie's coalfields and to near the Victoria falls.

† Moore

assistant surveyor in North-Eastern Rhodesia, and who himself has done good geographical work. He has been out there for some fifteen years. Eight or nine years ago he was working for the African Trans-Continental Telegraph Company, and in doing so he ran a line of survey from Nyasa by Tanganyika up to Lake Victoria, and he produced for our *Geographical Journal* an admirable map of the country he passed through. I ought to say that the map now in your hands and a more elaborate map which will appear in our *Journal* are practically the work of Mr. Beringer himself.

After the paper, the PRESIDENT said: Mr. Beringer has read us a most interesting paper, and I rise to propose a vote of thanks to both himself and the writer of it. That paper closes with a reference to the Geodetic Survey. We have present with us to-night Sir David Gill, the astronomer royal to the Cape for the last twenty-seven years. Last spring the Geodetic Survey stood in great risk of coming to a standstill in British territory, but Sir David Gill came to the front, and with extraordinary energy, and largely through Sir George Darwin in this country, funds were raised—I may say our Society contributed—and the Geodetic Survey in British territory went on, and no doubt will be completed.

Sir DAVID GILL: I was not aware that I should have to speak to-night, and had I been a right-minded official I should have insisted on notice. Not being a right-minded official, I will endeavour to say a few words, and, in the first place, to thank Mr. Beringer for his excellent account of the history of the Geodetic Survey in Northern Rhodesia. The fact that one year of the work was given to the Boundary Survey, of which there was immediate need, naturally robbed the Geodetic Survey of one year's work, and the famine and the other difficulties which arose certainly hindered very much indeed. There were other causes, which I need not enter into, which have led to the non-completion of the work within the three years which it was originally estimated to require. So far the measurement of the arc of meridian has been carried up to lat. 11° 30′ S., that is to say, to about here (indicating on map), and there is only that little bit to do to take it up to Lake Tanganyika. Perhaps I may be excused if I point out what are the great objects of this geodetic work. It was commenced in 1883, carried through Cape Colony and Natal; from Natal it was carried through the Transvaal and the whole of the Orange River Colony. It is complete to the Limpopo, and again it was resumed here in the neighbourhood of Gwelo. Why this gap arose was the fact that it was necessary, for the purposes of the British South Africa Company, to make a part of the triangulation not purely a part of the geodetic arc, because they desired the survey to begin near Bulawayo, in connection with the survey of the mining areas. Accordingly the triangulation in Rhodesia was first carried from Bulawayo eastwards to Gwelo and Iron Mine, and then Mr. Rhodes decided that it should go northwards to the Zambezi, and afterwards onwards to Tanganyika, promising that if the Transvaal did bring their triangulation along the 30th meridian from Natal to the Limpopo (a work not then begun), he would undertake to fill the gap from Gwelo to the Limpopo. When the survey of the Transvaal had reached the Limpopo, and survey operations in the Transvaal were on the point of abandonment, it seemed most desirable, before the surveyors were dismissed, to complete the little gap between Gwelo and the Limpopo. I may say that the Chartered Company at first said, "No, we have done our share; we have done enough." I wrote to various people in England, trying to get them to press the directors of the Chartered Company, and I admit they have been very good indeed, and they said, "We ought to be helped in this great scientific matter." Sir George Darwin took the matter up, and coaxed the British Association, the Royal Geographical Society, and the Royal Society, and several private individuals to give

us £800, and the Chartered Company promised to give me pound for pound, and said, "You must complete it for £1600." Well, I hope we shall. Captain Gordon is hard at work upon this bit, and he says unless he is eaten by lions he thinks he will get through. I want to point out what a tremendous thing this will be. When we have got to Cairo, we have only to go round that little bit of the Mediterranean, and that carries the work directly to Struve's arc on the 30th meridian from Turkey up to the North Cape, so that we shall have a complete arc of 105°, the longest arc measurable on the face of this globe. It is a very great work, a work of extreme importance to geodetic science, and, of course, of extreme importance to geography. We shall have this backbone of solid triangulation sure and certain within the accuracy that man is capable of obtaining as a basis for all future map work, which will relieve us from those tremendous uncertainties which too often beset the work of travellers and map-makers. I ask for the sympathy of you all, and of the Geographical Society, in helping me to get this great work completed. I may add that the work has already been begun under Captain Lyons in Egypt, and that the British Government has already started the work of reconnaissance for a part of the arc immediately north of Lake Tanganyika. The Berlin Academy of Sciences has already approached the German Government, urging that the work be taken up through German East Africa from north to south of Lake Tanganyika, and so joining the British work about to be commenced north of Tanganyika. It is, therefore, of the utmost importance that the arc be carried from lat. 11½° S. to the southern end of Lake Tanganyika. I won't promise you that I shall never come back and ask the Royal Geographical Society for more money. But I may say the British South Africa Company owes a debt to the promise and the memory of its great founder, Cecil Rhodes, who said to me, "I will see that arc of meridian carried out." And although they have responded nobly, I am sure we shall do all we can to help them, and I hope they will not consider that all their responsibility is already fulfilled.

The PRESIDENT: I think we might now hear the Chartered Company. Sir Lewis Michell is here to-night, whom you all know by name as having been, I forget for how long, the guiding spirit of the Chartered Company in London.

Sir LEWIS MICHELL: I am not going to detain you with a long speech to-night, but I think we are very much indebted to Mr. Wallace for having prepared this very interesting paper for us. Personally, I am always glad to acquire information, or to see my friends acquire information, and more especially is that the case when the information relates to any portion of that vast empire which we are sometimes accused of having built up in a fit of absence of mind. The portion dealt with to-night is quite an outlying post of the empire, and almost unknown; but thanks mainly, I think, to the members of this Society, the Dark Continent is dark no longer. It perhaps was never so black as it was painted. But, in any case, it is now getting less dark than it was; the clouds are rising and the shadows are vanishing, and we shall soon know all that is to be known about the heart of Africa. I dare say many in this room will remember the interest with which they read the memorable books of Stanley, in which, amongst other things, he talked with the greatest respect of that mysterious river the Luapula, and here to-night comes Mr. Wallace and talks of the Luapula as if it were a mere ordinary waterway, like the Thames at London Bridge. And this persistence in travel is what is gradually contracting the horizon of Africa, and making us in this country know all about it. Now, I venture to think that the time is approaching when the portion of Northern Rhodesia which has been dealt with to-night will prove of very great value. In the first place, I notice that Mr. Wallace dwelt very rightly upon the fact of its being high plateau land. Now that, I think, is of

enormous importance. It would be criminal to tempt people from this country to go to the malarial swamps and rivers of some portions of Africa. But a country that possesses thousands of square miles of high plateau land in the heart of Africa is a very valuable possession indeed, and the day will come when the inhabitants of these crowded isles may be glad to go to a country like that and make it their home. That was the dream of Mr. Rhodes's life. What will finally induce them to do so is not for me to say. I should not like to hint that it may be caused by the pressure of the rates, but in any case we may reasonably expect that before many years are over that elevated plateau which extends over almost the whole of Rhodesia, both north and south of the Zambezi, will be populated by white inhabitants. I believe that the settlers will gradually acquire what Mr. Rhodes called "more homes" there, and in that way the territory in the long run will be of inestimable benefit to the mother country. With regard to the Geodetic Survey, I do not feel at all qualified to speak, especially after the astronomer royal at the Cape has spoken to you to-night. I will, therefore, only say this—that the Chartered Company in its various surveys has altogether spent a matter of between £25,000 and £30,000, and it has done its best to forward the objects which scientific men like Sir David Gill have so much at heart. We have played our part, we have done our best so far as means will permit, and I hope Sir David Gill will live to see that arc of the meridian fully surveyed and determined.

The President: I will now call upon Mr. Wilson Fox, who, as secretary of the Chartered Company for many years past, has been more closely connected with Rhodesia than any living person since Mr. Rhodes's death.

Mr. H. Wilson-Fox: I feel I may claim your indulgence this evening if I say a few words, because, during the many years I have been a constant attendant at these meetings, I have never previously had the honour of addressing you.

I will not attempt to speak to you about these extraordinarily interesting rivers, plains, swamps, and mountains which Mr. Wallace and Mr. Beringer have had the good fortune to visit. The only reason I wish to say a few words to-night is this. I am most profoundly impressed with the great work which is carried out by men like my friend Mr. Wallace. All of you who have had the honour of meeting him will know that he is one of the most modest, one of the most unassuming, and, at the same time, one of the most clever and earnest workers in the field of geographical research. Mr. Wallace and Mr. Beringer are daily engaged in doing this work, with the assistance of a large staff of willing helpers. These helpers are men whose names none of you will probably ever hear. Most of them are district officers, who with their compasses or their plane-tables are filling in the gaps of the British Empire. Their work is typical of the work which is making this great Empire. It has been the most interesting thing to me year after year to watch the process of filling in the gaps in the maps, which at one time were covered with only a few dotted-in rivers, but which now are gradually assuming form, and one begins to speak quite familiarly of places of which a few years ago one had never heard. That, I think, is great work, and it is not the least important work of the British South Africa Company with which I have the honour to be connected. That company in a few short years has carried forward quietly and successfully a policy of which we hear a good deal elsewhere in Africa, but not always with the same results, a policy of peaceful penetration. The chartered territories have neighbours on two sides which are governed by the methods of Crown Colony government. Now, I do not wish to be severe on Crown Colony government, but I must state the fact that in no Crown Colony territories which are adjacent to Rhodesia is there a single mile of railway or telegraph which has not been constructed through the instrumentality of the British South Africa Company. The British South Africa Company has had to supply

both the railways and the telegraphs for the neighbouring territories as well as for its own. That is a significant fact, and one on which we should all do well to ponder. Then with regard to this matter of the Geodetic Survey. I can only hope that Sir David Gill—and, if I may say it without offence, he is a sturdy beggar—will be as successful with the Imperial Government as he has been with the British South Africa Company. And, as Sir David has given away the secret history of his negotiations with the Chartered Company, I should like to add one fact he has omitted, and that is that after inducing the directors to put pound for pound into the survey, he still was not satisfied. He immediately wrote a letter asking if they would not carry the men and the stores for the survey free on the railway. I hope Sir David will apply these methods to the Imperial Government, and with the same success.

The President: I will now ask Mr. Goode, the secretary to the North-Eastern Rhodesia Administration, to say a few words, because he has lived on the spot.

Mr. Goode: It is a great pleasure to have had the opportunity of hearing Mr. Wallace's interesting paper read at this meeting, and to join in the appreciation of the record of scientific work already accomplished in North-Eastern Rhodesia by Mr. Wallace, and those who have assisted, in the direction in which so much practical and stimulating encouragement has always been received from your Society. We hope soon to be able to add to the information available about the topography and geology of the country, the results of the Geodetic Survey, which, as you have heard, owes its inception to Sir David Gill, to whom we in North-Eastern Rhodesia are so much indebted in many ways for ready help and kindly advice. North-Eastern Rhodesia is proving itself a locality of singular interest also in its natural history. Mr. Neave, who was attached to the Geodetic Survey as naturalist and spent two years in the country, has been able to obtain a very large and excellent series of specimens of mammals, birds, fishes, insects, and so forth, which will be seen at the Natural History Museum and the Manchester Museum. In reference to the prediction made by Mr. Wallace in his paper that in the dense patches of the tropical forest some species would be found belonging to the forest country of the Congo, I think it is very interesting to know that among the collection of birds brought home by Mr. Neave there were several distinct West African species totally unexpected by the authorities of the Natural History Museum. When the account of Mr. Neave's work is published, I feel sure that it will be clearly shown that there is a great field for further discovery in this direction. From the figures given by Mr. Wallace in his paper, it must be strikingly evident that certain districts of the country are extremely sparsely populated, and, considering the large area of the territory, the total population is small, so small almost as perhaps to give ground for reasonable doubt as to the possibility of the population being able to supply sufficient labour for future industrial development. I think, however, that this smallness of population may be attributed in no small measure to the comparatively recent unrestricted and sanguinary activity of certain predatory tribes, such as the Angoni and the Awemba, and to the decimating ravages of small-pox. Under a sympathetic administration, there is no doubt the population is now steadily and in some cases rapidly increasing. Relieved from the fear of home attacks, the young and enterprising native of some position can now start out and make a new village for himself with merely the small nucleus of his own family and perhaps a few dependents. This is occurring in some districts almost daily, and it has exercised and must continue to exercise a very stimulating effect on the birth-rate. Small-pox, though it is impossible to say that it can be utterly stamped out or exterminated, is controlled by Government measures, and can never claim the number of victims

it used to claim in the days before the establishment of the Chartered Company's administration. I am afraid I have nothing of any scientific value to add.

The PRESIDENT: I do not know if any Fellow present would like to address the Society; if not, I will put the vote of thanks I proposed to both the reader and writer of the paper.

IRRIGATION IN THE UNITED STATES: ITS GEOGRAPHICAL AND ECONOMICAL RESULTS.

By JOHN H. BEACOM, Major U.S. Army.

SCIENCE, in all probability, made its first great contribution to the wealth of nations by creating oases in the desert.

Under the influence of scientific irrigation, the barren plains drained by the Tigris and Euphrates became so wonderfully productive that for many generations they constituted the richest possession of the Powers that swayed the East—of Nebuchadnezzar, of Cyrus, and of Alexander—Opis, Bagdad, Ctesiphon, Selucia, and Babylon grew up in these valleys and became famous for their wealth and luxury. But all these cities, with the exception of Bagdad, perished long ago, and the plain on which they stood is again a desert. A similar fate befell the cities of Seistan and of many other places that were dependent upon irrigation.

If we turn from Asia to the so-called New World, we find remains of irrigation works that were as well built, as extensive, and as old as those we have mentioned; and apparently the people who manned them were as numerous and as prosperous and, in the end, as unfortunate as those who dwelt by the Tigris or the Helmand.

It would be interesting, and not wholly out of place in a paper on this subject, to consider how man has been affected by the conditions of life in irrigated districts—by its certainty as compared to the uncertainties in the life of the agriculturist who looks to the wandering clouds to water his land; by its fixity, its narrowness, and its monotony. But is it not evident, without going very deeply into the history of irrigation, that such an environment would tend to make a man less self-reliant? Would it not unfit him to resist the inroads of men from the mountains or from the waterless plains where the precarious conditions of life develop courage and individuality? Would it not in time unfit him to resist the encroachments of the desert, which, like man, is ever anxious to add to its dominions?

I have no doubt that, if the history of the great irrigation areas in Asia Minor, Turkestan, India, Egypt, and in the western parts of North and South America were fully known, we should discover some interesting parallels in the history of the peoples who became masters and then slaves in those widely separated regions, and that we should be justified

in concluding that the conditions surrounding the irrigation-agriculturist are bound in time to convert him into a serf.*

We may not all be of one mind as to the influence of irrigation on society, but we all know that the spirit of the desert has been able frequently to again make desolate large areas which for a long period of time man has made to yield an abundant harvest. We know, also, that the various peoples who to-day inhabit such remnants of these ancient systems as are still irrigated are all under a species of bondage to men who have developed under a totally different environment.

Whatever the cause, there is no doubt that agriculture by irrigation was on the wane for many centuries both in the old and the new world. But now suddenly there has come a great awakening, and schemes more comprehensive than those of Nebuchadnezzar or the Pharaohs of the Twelfth Dynasty are to be carried out in this wonderful moment of time in which we are living.

In the valley of the Nile there are projects affecting regions lying thousands of miles above the Delta of that river. In northern India some millions of acres are to be added to existing areas under irrigation. It is even proposed to renew the struggle with the desert in Asiatic Turkey and Seistan. In the United States and Canada they are building works to irrigate larger areas than are under irrigation in any of the above-named countries.

And who is it that is doing all this? Is it a people that have been sitting by irrigating ditches for some centuries? Not at all. It is the great wandering race—the Anglo-Saxon.

Of all these great schemes, we are specially concerned to-night only with those that lie within the limits of the United States.

Irrigation and drainage, while designed to remedy evils that are opposite in character, have the common object of adding to the agricultural area of the country, and both are now coming very much to the front in America. It is estimated that as large an area can be reclaimed by drainage in the humid regions east of the 100th meridian of longitude as can be reclaimed by irrigation in the arid and semi-arid regions west of that meridian. Moreover, the density of population and the price of land in the eastern half of the country has reached the point where irrigation, notwithstanding the humidity, begins to pay just as it has done in some of the humid districts of Europe. Consequently, in the eastern half of the country, both irrigation and drainage will receive considerable attention during the coming years, but I shall confine myself to the irrigation areas of the arid and semi-arid states, and shall consider drainage only as a necessary adjunct to irrigation.

A century ago it was generally believed that the semi-arid and arid

* See pp. 8 and 9, 'Tibet and Turkestan,' by Oscar T. Crosby. Published by G. P. Putnam's Sons.

plains stretching far to the east and to the west of the Rocky mountains were unfitted for the habitation of man. It was believed that the tide of emigration, which was then moving westward from Europe, might eventually reach the eastern edge of this so-called desert, but could proceed no further; but so many were the men that came with that tide, and so great was their hunger for land, and so liberal were the provisions of Government for acquiring it, that in a few years they had crossed the Alleghany mountains, the Mississippi and the Missouri rivers, and were beginning to invade the so-called desert that lay some distance beyond. As the hardy pioneers in this movement advanced farther and farther, the greater were their difficulties, and they finally reached a point where the generosity of Government was counterbalanced by the difficulties imposed by nature. Government then passed a series of laws designed to strengthen the hands of the settler in his struggle with nature.

As some knowledge of the various land laws is necessary to a proper understanding of the situation in the arid and semi-arid regions where the Government is now carrying out its irrigation projects, I shall give a brief outline of them.

The Homestead Law.—This is the law under which the title to most of the land west of the Alleghanies which is now held by individuals was first acquired. It provided that any person who was the head of a family or twenty-one years of age, and a citizen of the United States, might enter upon 160 acres of public land and acquire title thereto by paying five shillings an acre and residing thereon for five years.

The Timber Culture Law.—This law was passed in 1873, and was designed to promote tree-culture in timberless areas by giving title to 160 acres of land to the head of a family, provided he would plant 10 acres of timber on this tract, and keep it in a healthy growing condition for eight years. This law was repealed in 1891.

The Desert Land Act of 1877.—This law provided that the head of a family, or any person twenty-one years of age, and a citizen of the United States, by paying in advance a shilling an acre, and declaring that he would reclaim the land by conducting water upon it within three years, might enter upon 640 acres of land classified as desert land. But before a patent was given him for this land he had to show that he had spent at least twelve shillings an acre in the irrigation, reclamation, and cultivation thereof; and in addition thereto he had to pay four shillings an acre, making a total of seventeen shillings an acre. In 1891 this Act was amended, limiting the entry to 320 instead of 640 acres.

Under this Act considerable semi-arid land was reclaimed, but it did not meet all requirements. What was needed was a law that would favour large irrigation projects which require the investment of much capital.

Transfer of Arid Lands to the Several States.—The next step taken by

Congress in support of irrigation was in 1894, when a law was passed providing for the transfer to each of the states "Such desert lands within the state, not exceeding 1,000,000 acres, as the state may cause to be irrigated, reclaimed, occupied, and not less than 20 acres out of each 160-acre tract, cultivated by actual settlers within ten years after the passage of the Act."

SALT RIVER PROJECT, ARIZONA. DESERT AS THE GOVERNMENT ENGINEERS FOUND IT.

The Reclamation Act. — But the most important of all the Acts of Congress affecting irrigation was the Reclamation Act, which was passed on June 17, 1902. As most of the great irrigating schemes to which I shall have occasion to refer were made possible by this Act, I shall give it somewhat in detail. It provided that all moneys received from the sale and

disposal of public lands in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming, on and after July 1, 1900, should be set aside as a special fund in the Treasury, to be known as the "Reclamation Fund," to be used in the examination and survey for, and the construction and maintenance of, irrigation works for the storage, diversion, and development of waters for the reclamation of arid and semi-arid lands in the above states and territories. The Secretary of the Interior was made the administrator of this fund, and he was authorized to make examinations and surveys for irrigation works, and to locate works for the storage, diversion, and development of waters, including artesian wells. He reports to Congress at the beginning of each regular session as to progress made in this direction.

The entryman upon lands to be irrigated by such Government works must comply with the Homestead Law, must reclaim at least one-half of the total irrigable area of his entry for agricultural purposes, and before receiving a patent for the land, he must pay to the Government, in ten or less annual instalments, the charges that have been apportioned against the tract. The area of each entry shall be such as, in the opinion of the Secretary of the Interior, may be reasonably required for the support of a family, and the charges per acre shall be the estimated cost per acre of the project.

The Government, wishing to prevent the acquirement of large areas by individuals and the possible absenteeism of owners, provided in the law that "No right to the use of water for land in private ownership shall be sold for a tract exceeding 160 acres to any one landowner, and no such sale shall be made to any landowner unless he be an actual *boná fide* resident on such land, or occupant thereof residing in the neighbourhood of said land."

It was further provided "That when the payments required by this Act are made for the major portion of the lands irrigated from the waters of any of the works herein provided for, then the management and operation of such irrigation works shall pass to the owners of the lands irrigated thereby, to be maintained at their expense under such form of organization and under such rules and regulations as may be acceptable to the Secretary of the Interior: Provided, that the title to and the management and operation of the reservoirs and the works necessary for their protection and operation shall remain in the Government until otherwise provided for by Congress."

It further stipulated that "The right to the use of water acquired under the provisions of this Act shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limit of the right."

The funds derived from this law have now reached the sum of £6,400,000 sterling, and the annual increment is about £800,000.

If we glance back over these several laws, we see that three of them relate directly to irrigation :—

(1) That of 1877, known as the Desert Land Act, which granted to the settler 640 acres of desert land if he reclaimed it within three years.

(2) That of 1894, granting to each of the arid and semi-arid states 1,000,000 acres of desert land, provided the State caused it to be irrigated, reclaimed, and occupied within ten years.

(3) That of 1902, known as the Reclamation Act, by virtue of which the general Government undertakes the construction of large irrigation works, and also the management of them until they can with

CEMENTED CUTTING TO PREVENT WATER FROM RUNNING AWAY UNDERGROUND.

safety be turned over to the people who have acquired a right to the beneficial use of the water which these works supply.

These three laws show how rapidly the irrigation idea grew in magnitude and importance. Under the first, success depended upon the capital and energy of the individual; under the second, each of the arid states became interested; while by virtue of the third, which was passed only twenty-five years after the first, the general Government becomes the leader and director of the larger enterprises.

The amount of land that had been put under irrigation by private and State enterprise up to June 30, 1900, amounted to 7,263,273 acres, and the cost of construction of the irrigation systems was £13,000,000. The amount under irrigation at the present time is 10,000,000 acres,

and the works have cost £18,500,000. With this as our datum point, we may now proceed to consider some of the Government projects; but first let us consider—

The Extent of Country to which the Reclamation Law applies.—The sixteen arid and semi-arid states constitute about half of the area of the continental part of the United States, or about 1,500,000 square miles. Much of this vast area is sufficiently humid to require no irrigation. Much that requires irrigation in order to become productive can never be reclaimed for lack of sufficient water in the lakes and rivers, or because of the engineering difficulties to be overcome in conducting water over it; but, according to the estimate of conservative engineers, it will be possible to reclaim about 50,000,000 acres in addition to the 10,000,000 already reclaimed.

Some idea of the extent of this reclaimable area may be gained by comparing it with the area in the United Kingdom under crops of all kinds, including hay, which, in 1904, was a little over 19,000,000 acres, or about one-third of the area of the desert lands that have been or will be reclaimed in the United States by means of irrigation. If we consider the great productiveness of an acre of irrigated land as compared with an acre of non-irrigated land, we see that this will be adding very largely to the agricultural domain.

In British India (exclusive of Burma, Beluchistan, and the Native States) there are about 45,000,000 acres under irrigation, which is an increase of about 11,000,000 in the last twenty-five years. Of this total area, about 19,000,000 acres are irrigated by State works, and about 26,000,000 by private works. The present programme provides for new State works that will add about 6,000,000 acres, thus bringing the total for India proper up to 51,000,000; but it will be several years before this programme can be completed. A portion of this area is not remunerative, but its protective nature in famine years justifies the Government in maintaining the works.

In all Egypt there are 5,538,000 acres under irrigation, and each year liberal allotments of funds are made for the study of vast schemes for the storage and control of the waters of the White and Blue Nile, with a view to the eventual irrigation of millions of acres of land in that part of the Nile valley, and to increasing the area of irrigation on the lower Nile as well.

Machinery for carrying out the Provisions of the Reclamation Act.—Shortly after the Reclamation Act was passed, a Reclamation or Irrigation Service was organized as a section of the Geological Survey, which is a subdivision of the Interior Department. The engineers belonging to this service investigate all irrigation projects, and report to the Secretary of the Interior; if he approves the project, the engineers then prepare detailed plans for the works, and proceed with their construction, or the secretary may let the work to contractors, in

which case the engineers act as inspectors to see that the work is properly carried out.

Twenty-four projects have already received the approval of the Secretary, and on all of them the work of construction has begun. The names and location of these projects, with the amounts already allotted to them, the approximate cost of each project when completed, and the acreage to be reclaimed by them, are shown in the following table:—

Location of project.	Name of project.	Amount allotted and to be allotted this year.	Estimated cost of completed project.	Acres to be reclaimed.
		£	£	
Arizona	Salt river ...	791,123	791,123	175,000
Nebraska-Wyoming	North Platte ...	684,270	684,270	100,000
Montana	Huntley	184,937	—	30,000
" and N. D.	*Lower Yellowstone	390,243	390,243	66,000
"	Milk river ...	205,486	—	100,000
Oregon	Klamath	410,973	821,946	240,000
"	Umtilla	205,486	205,486	20,000
California-Arizona ...	Yuma	616,459	616,459	85,000
Nevada	Truckee-Carson ...	616,459	1,849,378	400,000
Idaho	Minidoka ...	267,132	—	130,000
"	Payette-Boise ...	267,132	1,849,378	372,000
Colorado	Uncompahgre ...	513,716	513,716	100.000
Washington	Okanogan ...	102,743	102,743	10,000
"	Tieton	205,486	—	24,000
"	Sunnyside ...	154,114	—	40,000
Wyoming	Shoshone	462,344	462,344	75,000
South Dakota ...	Belle Fourche ...	431,521	554,813	85,000
North Dakota ...	Pumping Projects	205,486	—	80,000
Utah	Strawberry valley	256,658	—	50,000
New Mexico ...	Hondo	49,316	49,316	10,000
" "	Carlsbad	123,292	123,292	15,000
" "	Rio Grande ...	41,057	1,479,503	180,000
Kansas	Garden city ...	53,426	53,426	8,600

These works include a great variety of engineering problems: the construction of large dams and long tunnels, the leading away of rivers from their natural channels into the valleys of other rivers, the sinking of many wells and providing machinery for lifting their waters to the canals, etc. The country in which these works are located extends through 19° of latitude and embraces a wide variety of climate, and in planning the works all this must be borne in mind. In California or Arizona, for instance, the engineers must allow for the excessive evaporation, while on the Yellowstone, in Montana, they must protect the dams against ice gorges. A hasty glance at the more important features of a few of these projects, will give us some idea of the engineering questions that arise.

The Salt River Project in Arizona.—This involved the construction of a dam across the cañon of Salt river at an almost inaccessible point

* The "Lower Yellowstone" consists of two projects.

about 60 miles above Phœnix, and before commencing work on the dam, it was necessary to hew a roadway for several miles along the face of the wall rock of the cañon. When completed, the dam will be only 800 feet long on top, and 235 feet at the river-bed; but it will rise 284 feet above its foundations, and support a column of water 230 feet high. It will contain 1,400,000 acre-feet of water, which is more than

SKETCH-MAP OF THE WESTERN UNITED STATES, SHOWING IRRIGABLE AREAS.

is held by the great dam at Assouan. Ten thousand horse-power will be developed from the dam and from drops in the canals, and this power will be utilized to pump the underground water of the valley to lands that lie above the gravity systems. The area irrigated will be about 175,000 acres, and the entire project will be completed in 1909.

The Soshone Project in Wyoming.—This is very much like the Salt

river project in some respects, but it is much smaller, as it will irrigate only about 75,000 acres. It involves the construction of several miles of difficult roadway up the cañon of the Soshone, and the locking of this cañon by a dam 310 feet high. This makes it the highest dam in the world, I believe, but it is only 200 feet long on the top, and 85 feet at the base.

The Uncompahgre Valley Project in Colorado.—The Gunnison river in Colorado flows for a considerable distance through a cañon approximately 2000 feet deep, and with almost vertical walls. It would not be very difficult to lock this cañon; but a dam, even of the height of

DAM ACROSS CAÑON.

the one on the Soshone (310 feet), would come far short of lifting the waters to the level of the adjacent lands. But not far away, at a much lower elevation, lies the valley of the Uncompahgre, and the engineers discovered that, by building a low dam in the cañon of the Gunnison, and boring a tunnel through the wall rock, the waters of the Gunnison could be brought into the Uncompahgre. This is now being done, and the combined waters of these two rivers will be utilized to irrigate about 100,000 acres of exceedingly fertile land lying in that valley. The tunnel has a cross-section of $10\frac{1}{2}$ by $11\frac{1}{2}$ feet, and will be nearly 6 miles long.

The Truckee-Carson Project in Nevada.—This was the first irrigation work undertaken by the Government. It is more comprehensive, and

will require a greater outlay, than any other scheme that has so far been approved. It involves extensive storage-works on Lake Tahoe, the turning of the waters of Truckee river into Carson river, the construction of a large reservoir on the latter river, and the utilization of the waters of all rivers that now flow into Carson sink and are evaporated. The great dams required on the Truckee and Carson rivers, and the main irrigation canals leading from these, were the first works completed by the Reclamation Service, and they were formally opened on June 17, 1905, the third anniversary of the passage of the Reclamation Act. This scheme will reclaim about 400,000 acres of land that was formerly worthless desert, but which, when once reclaimed, will be worth £6,000,000. The Government expenditure will be nearly £2,000,000, and this must be supplemented by large expenditures on the part of the settlers before reclamation will be complete.

The Projects on the Yellowstone River in Montana.—There are two projects on the Yellowstone. The works of the lower one are about 19 miles below Glendive, and those of the upper or Huntley project are near Billings. The dams are being constructed in both cases with special reference to preventing the formation of ice-gorges, which sometimes cause much damage on this river, and with this end in view, they will be timber-covered, and the curved face will be downstream.

The Klamath Project in Southern Oregon and Northern California.—The Klamath valley contains three large lakes—Upper Klamath, Lower Klamath, and Tule or Rhett lake; but when the engineers have carried out their plans only the Upper Klamath will remain.

The Lower Klamath is to be drained by cutting a canal through the natural dyke which preserves its present level, and its exposed bed will be divided into farms and irrigated. Tule lake will be eliminated, but by a different process. This lake receives its entire supply of water from a river—very properly called the Lost river—which wanders about in a confused way for some 60 miles, and finally arrives at a point only 6 miles from where it started. This river is to be dammed, and its waters drawn off to irrigate lands lying in the valley, and, as a result, Tule lake will dry up, and its bed will then be irrigated. In all about 240,000 acres will be brought under irrigation, and at a cost of only about £3 10*s.* per acre, which is the lowest estimated cost of any of the Government projects. The engineering questions involved are of the simplest nature, and yet the character and appearance of all that part of the Klamath valley will be completely changed.

The Rio Grande Project in New Mexico.—The project has been approved, but the work of construction has scarcely begun, as the allotment is very small. The cost of the entire project will be about a million and a half sterling, and about 180,000 acres will be irrigated, but it will probably be several years before the works are completed. The main

feature of the project is the construction of a great dam by which a reservoir will be formed having a capacity of 2,000,000 acre-feet.

Irrigation has been carried on in this district for a long time, and a good many disputes have arisen between the people of New Mexico and Texas concerning their respective water rights, and some controversies, not easy of adjustment, have arisen between the United States and Mexico over similar questions; but in the allotment of the waters of this great reservoir the Government will endeavour to compose all these difficulties.

The Payette-Boise Project in Idaho.—This is a large project, as it

LOOKING DOWN THE TRUCKEE CANAL THROUGH ONE OF THE ROCK CUTS.

provides for the reclamation of 372,000 acres, at a cost of about £1,800,000. The flood waters of the two rivers, the Payette and the Boise, are to be stored, and as the Payette has more water than is required to irrigate the lands naturally tributary to it, and as the Boise has not enough, the surplus waters of the Payette are to be diverted into the valley of the Boise. The soil in this district is excellent, and the climate such as to admit of a wide variety of products.

The Yakima Valley Project (including the Sunnyside and Tieton sub-projects) in Washington. — The Yakima river has its source on the eastern slope of the Cascade mountains, and flows in a south-easterly direction until it empties into the Columbia some distance above Walla Walla. There are about half a million acres of land in this valley that

could be irrigated if the supply of water were sufficient, but the Government engineers estimate that storage cannot be developed for more than 300,000 acres.

The proposed system is an extensive one, consisting of the following sub-projects: the Ledbetter (210,000 acres); the Sunnyside (40,000 acres); the Tieton (24,000 acres); and the Kettitas (60,000 acres), and it is found that each of them can be treated as a separate unit. So far only two of them have been approved—the Sunnyside and the Tieton.

There is an irrigation system already in operation at Sunnyside, but this has been purchased by the Government, and will be made a part of the more comprehensive system. The purchase of existing systems is contemplated wherever Government ownership will facilitate the full development of the larger scheme as planned by the engineers, and a number of small works have been purchased already. The estimated cost of the entire system is £2,500,000.

Pumping Projects.—The first pumping project to receive the approval of the Government is the one at Garden City, Kansas, where water sufficient to supply 8600 acres will be drawn from the underground supplies. There will be twenty-three pumping stations, each driven electrically from a central power station.

In North Dakota four pumping projects have already been approved, and they provide for the irrigation of about 80,000 acres. Both steam and electric power will be used, and the lifts will range from 40 to 80 feet. Power will be developed from lignite, which is found in great abundance in the vicinity of the stations.

There are projects on three rivers—the Platte river, Milk river in Montana, and the Colorado—to which I wish to refer, not only on account of their engineering features, but also on account of the legal questions involved.

The *Platte river* has two main branches, both of which rise in Colorado. The South Platte flows direct from Colorado into Nebraska, but the North Platte passes through Wyoming before it enters Nebraska. Each of these three states has its own laws governing the right to the waters of streams within its borders, and is inclined to ignore the rights of those living on the same stream but in another state.

In order to remove the many causes for dispute in such cases, the Government is making a very thorough investigation of the laws and institutions relating to the use of water both at home and abroad, and it hopes before long to establish an equitable system of distribution. The river Platte is taken as a good example of an interstate stream, and it is being studied very carefully to determine the effects of diversion from one section of the stream upon the flow in lower sections of the stream, as it is necessary to know just what becomes of diverted water in order to determine to what extent diversions may be made without interfering with the rights of people and states farther down-stream. Moreover,

the Government is building a reservoir on the North Platte capable of storing more than a million acre-feet of water, which is intended to irrigate 100,000 acres of land lying partly in Wyoming and partly in Nebraska, and it is necessary to know just what effect this will have on lands already under irrigation.

The river has been divided into sections, varying from 1 to 50 miles in length, with an observation station at each end of each section. Careful measurements are made of the discharge at the upper station, of the inflow and of the diversion between the upper and lower station, and of the discharge at the lower station, and thus the gain or loss for

POWER SITE JUST BELOW THE NORTH PLATTE DAM SITE, LOOKING DOWN CAÑON.

the section is determined. These measurements have been taken for some years, and will continue to be taken until it is fully determined just how much of the water used for irrigation returns to the river by seepage, and how long it takes it to get back.

Some general conclusions can be drawn from the data already at hand relating to the Platte river. (1) That much of the water taken from the river eventually returns. (2) That if the water be carried some distance from the river, it may require years for it to return. (3) That irrigation areas on the lower stretches of a river may be benefitted by having the water of the river drawn off on the upper sections, as it may be returned just in time to increase the flow in the lower sections at the time of year when water is most needed.

The Milk River Project.—Legal questions similar to those arising in the Platte valley are involved in the Milk river project, but their settlement depends, not on inter-state, but on international comity.

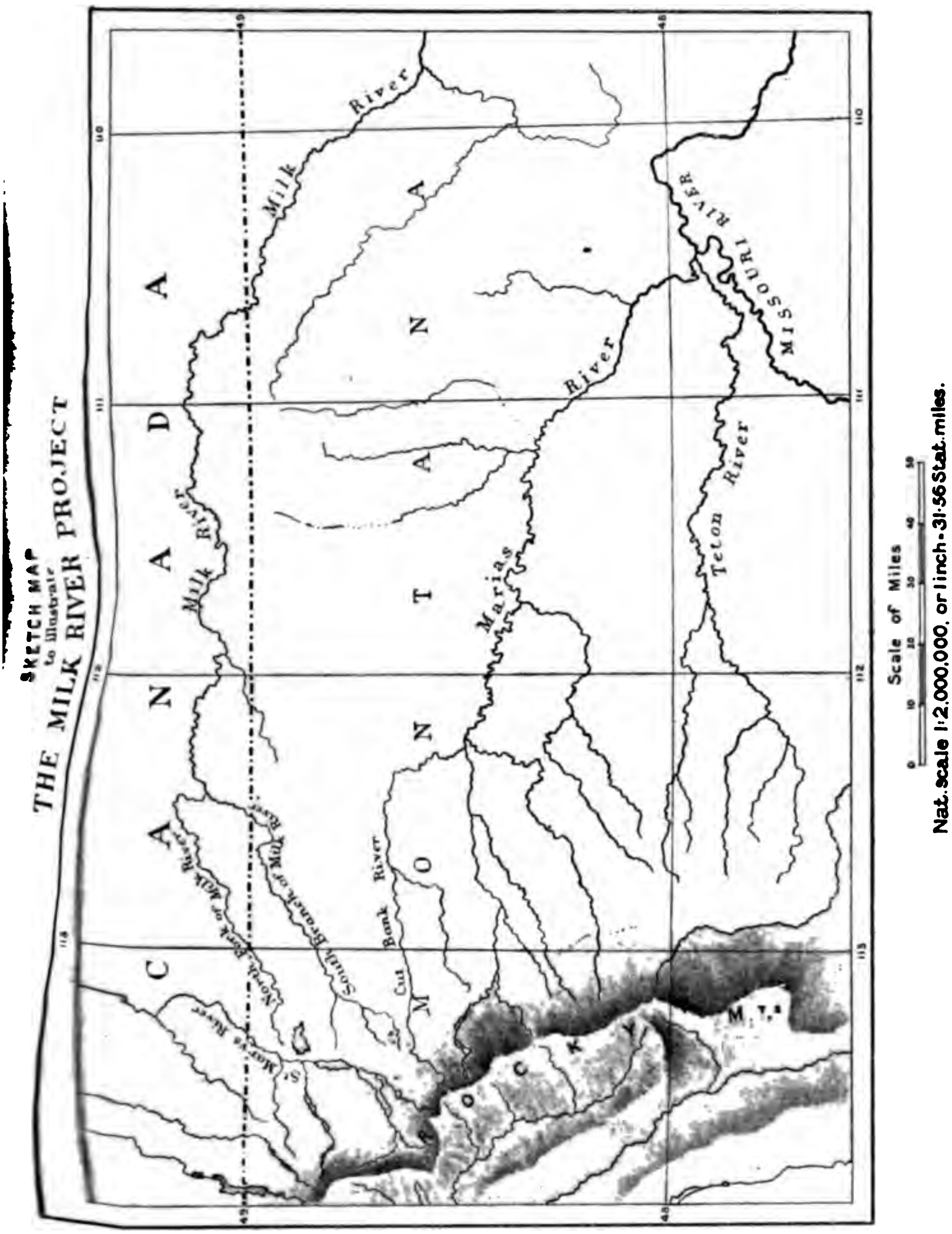
The situation is about as follows: Two rivers, the St. Mary's and Milk river, rise in Montana on the eastern slope of the Rocky mountains, and a little south of the international boundary-line. The St. Mary's is a mountain stream, and on issuing from the mountains it runs north, crosses the boundary-line, and finally reaches Hudson bay.

Milk river is a prairie stream, having its source only a little way east of the St. Mary's river, and it also flows north into Canadian territory, but after wandering through that country for about 150 miles, it returns to the United States, and its waters finally reach the Gulf of Mexico.

Several years ago some enterprising Canadians (who happened in this instance to have gone from the United States) took up land on the lower St. Mary's, and began to irrigate it, and they were so successful that a company is now building works on that river that will irrigate several hundred thousand acres.

In the valley of Milk river, in Montana, there are also many thousands of acres of rich land awaiting irrigation, but there is not enough water in that river to meet the requirements of such a large tract. In fact, the small areas that are already under irrigation are threatened by the large works projected on that part of the river which lies in Canada. To make good this shortage, the engineers of the Reclamation Service proposed some years ago to build a dam on the St. Mary's river 50 feet high, and to cut a canal through the low divide separating St. Mary's river from Milk river, and thus divert as much of the water of the former into the latter as might be required for the irrigation of 100,000 acres lying along its lower stretches. They believed that the addition to the stored waters of the St. Mary's river resulting from the building of this dam would permit this to be done without interfering with existing diversions from these rivers in Canada or Montana. Then there arose between the American and the Canadian a great discussion as to what parties are entitled to the use of the waters of a stream. The Canadian argued that St. Mary's river had been flowing through its present channel to Hudson bay for thousands of years, and that no one had a right to divert it to another channel and another sea. The American answered that the heavens first deposited these waters on American soil, and that the owners of that soil had a right to the use of them. The Canadian then declared that if these waters were diverted into Milk river, he would draw them all off when that river entered Canada, and that they would never get back to Montana. Then the American declared that, instead of diverting the waters into Milk river, he would lead them into the Cut Bank river, which flows into the Marias, and thence on to the Missouri, without ever passing into

Canadian territory. And so the discussion goes on, and will continue to go on until an equitable allotment of these waters is provided for by



treaty. Such a treaty is being drawn up, I believe, and let us hope that its provisions will satisfy all parties concerned.

The Colorado River.—The region drained by this river has double the area of the United Kingdom; its lofty mountains, its grand cañons, its desert wastes, and its many other natural wonders give it a peculiar interest. In elevation it ranges from 12,000 feet above sea-level to 300 feet below sea-level; climatically it extends from Sweden to Egypt; its southern portion, both in soil and climate, is *very much* like Egypt; and its great river resembles the Nile in many respects; both are flood rivers, and in their lower stretches flow through a semi tropical and practically rainless desert, and each has formed a great delta, which it overflows and enriches annually. I do not know what the calculations are as to the amount of silt and detritus carried by the Nile, but it is stated on excellent authority that when the Colorado is in flood it carries 1,500,000 tons past each point south of the grand cañon every twenty-four hours. No wonder that in the course of ages it has made its mark in the world; that it has cut a great cañon through the mountains several hundreds of miles in length, and in many places a mile deep. It carried all this material, almost incalculable in amount, down from the mountains, and built up a great plain with it, and at the same time it built a great dike or highway for itself well above the level of that plain. When it reached the Gulf of California, it kept on with its building scheme until it formed a great bar clear across the gulf, thus cutting it in two. The northern arm of the gulf, when once cut off from the sea, gradually disappeared, as the inflow of fresh water was not enough to overcome evaporation, and its bed finally became a great sunken salt desert; then each year the river overflowed its banks, and some of these salts were washed down to the lowest parts of the depression, and on the slopes a layer of rich sediment was deposited.

It was only a few years ago that man began to meddle with this situation: he began to take salt from the great deposit at the bottom of the depression; he made an opening in the bank of the river, and by the aid of its waters converted the slopes into very productive farms; he built a railway through the valley to transport the salt from the mines, and the various products from the farms to the markets; and in a few years what had been known as "Colorado Desert" acquired the name of "Imperial Valley." All went well for a time, but unfortunately the engineers of the irrigation scheme had not reckoned with the Colorado river. They put no permanent headworks in the canal; and one day in 1905, when the river was in flood, it enlarged the canal opening, and greatly increased the amount of water drawn off by the canal, and it kept on increasing it until now nearly the entire Colorado is discharging into this ancient sea-bed, and a fresh-water lake is being formed. The salt works have already been destroyed, and the railroad has been compelled to move to higher ground. The engineers are struggling with the mighty task of turning the river back into its old channel, but as this new lake, this youngest child of nature, is already 60 miles long

several miles wide, and is growing rapidly every day, it may be t the 80,000 acres of irrigated land will be submerged, and the eight en thousand people who live in the valley will be driven from their ıes before the engineers shall have succeeded in their undertaking. xico, as well as the United States, is interested in the outcome, as the er portion of the delta is Mexican territory.

It is estimated that 1,300,000 acres of land are so situated that orado river waters could be used on them, but the amount of water

uired for such an area is much more than the river can furnish at its state; it will be necessary, therefore, to store the flood waters in er to increase the supply at the season of minimum flow. Reconssances already made show that below the grand cañon no reservoir s exist, and that suitable places for storage of the flood-waters of this r and its tributaries must be sought higher up at points a thousand es or more above the delta, but some years of study and investigation l be required before the problems involved in this great scheme can solved. These problems are not unlike those of the Nile, but the

Colorado has no great natural reservoirs such as the Nile has in Lake Victoria and Albert Nyanza.

In the lower portion of the Colorado valley there are three important irrigation areas—

Private enterprise, as we have seen, has put 80,000 acres under irrigation in Imperial valley.

The Government project on Salt river, already referred to, provides for the irrigation of 175,000 acres more.

Another Government project, known as the Yuma, will irrigate 85,000 acres lying in Arizona and California. A great dam, nearly a mile long, will be thrown across the Colorado river about 12 miles above Yuma. As it will rest on a bed of sand, it will depend on its mass for its stability. It will have a length up and down stream of 267 feet, with a height of only 19 feet; and there will be two canal systems, one on either side of the Colorado, with headworks at opposite ends of the dam. The waters of the canal that has its headworks at the eastern end of the dam will be carried under the Gila river, which flows into the Colorado a few miles below the dam, by means of a siphon of steel and concrete about 3300 feet long. This great length is necessary on account of the great floods on the Gila, and the consequent changes in the channel. The Gila and the Colorado both overflow their banks in this region, and it will be necessary to build levees on both sides of them to protect the irrigated land from inundations.

These three projects—the Imperial valley, the Yuma, and the Salt river—will irrigate about 250,000 acres. If we add to this the smaller areas already under irrigation, or to be put under irrigation in the near future, we have a pretty large district, and one of great potentiality. The soil is very fertile, and the climate is so hot and dry nearly all the year round, that, with the aid of irrigation, it is destined to become the garden spot of the continent. Many tropical and semi-tropical plants that cannot be grown in other parts of the country will grow luxuriantly under these new conditions. The palm tree and many bits of old-world landscape will be reproduced here, and a few years hence it will be possible for the Arizona farmer to recline under his vine and fig tree and read his Bible amid a real Bible-land environment.

The process of converting a desert into a productive farm consists of three stages—

(1) The construction of the irrigation works.

(2) The preparation of the land to receive the water.

(3) The selection and cultivation of the plants.

The Secretary of the Department of the Interior, as we have seen, is responsible for the construction of the works; but from that point on, the success of the enterprise depends mainly upon the man who has settled on the desert land. But he is not left to work out his salvation alone and unaided, for at this point in the process the Secretary of the

Department of Agriculture steps in, and by his aid and advice assists the settler to carry on the undertaking to a successful conclusion.

This latter official is charged with the supervision of all public business relating to agricultural industry, and more than a million pounds is allotted annually for carrying on the work of his department. This is a large sum, but very little when compared with the value of the farm products of the country, which now amount to the "unthinkable aggregate" of more than a billion pounds sterling annually.

A fair portion of the money expended each year by this department is devoted to irrigation investigations, with a view to protecting the

A HOME NEAR PHŒNIX, ARIZONA, SHOWING THE EFFECT OF IRRIGATION IN THAT REGION. SALT RIVER IRRIGATION PROJECT.

great capital which, as a little calculation shows, will be invested in this business.

The charge against each acre reclaimed is about as follows:—

		£	s.		£	s.
For construction of works	from	3	10	to	10	0
For clearing away sage brush, etc.	„	0	6	„	1	0
For levelling the surface	„	0	4	„	3	0
For laterals and diversion boxes	„	0	4	„	3	0
Total initial cost per acre	„	4	4	„	17	0

If we take £10 as an average, we find that the aggregate cost of

reclaiming 50,000,000 acres would be £500,000,000, or twenty times the cost of the Suez canal.

It is evident that the really poor man cannot become an irrigation farmer, for, in addition to the initial cost per acre, as shown above, there is the necessary outlay for buildings, machinery, and tools, and the cost of seed and water for the first crop. Neither can the stupid man afford to embark in this business, for, with such a costly plant, a series of mistakes would prove disastrous.

As the Government constructs only the irrigation works, there are many things for the settler to do before he is ready to sow the seed for his first crop. He must clear the ground of sage brush or other rubbish; he must level it so that a proper amount of water can be applied to all parts of it, and he must construct the necessary laterals and diversion boxes. To an old hand these are comparatively simple matters, but to any one new to the business they seem very complex and difficult. Most of the men who are now entering upon these lands come from the humid regions where conditions are very different, and, although intelligent as a class, they know little about these matters. To minimize their mistakes the Government has issued a "Farmers' Bulletin," which explains, in clear and simple English, the different methods employed in this preliminary work, and gives photographic reproductions and drawings of the implements required.

Having prepared the land in accordance with the instructions in the bulletin, the next thing for the irrigation farmer to consider is the best method of applying the water to his particular crop, and he finds in this same bulletin many suggestions. The various systems are discussed—the check system, flooding from field ditches, the furrow system, and the basin method—and the advantages and disadvantages of each are pointed out.

But even if the farmer makes no mistakes in any of these things, his land may still be rendered valueless by conditions arising from irrigation, but over which he, as an individual, has little or no control, and it is therefore necessary for the Government to look after his interests.

In India and other irrigation countries, and in the United States as well, large areas of once productive land have been abandoned because of the rise of alkali, or in consequence of swampage caused by seepage from the over-watered higher-lying lands and from the canals. The low-lying ground receiving the seepage soon becomes saturated at some distance below the surface, and the plane of saturation gradually rises until water is so near the surface as to kill vegetation, or it may rise above it. This rising ground-water brings with it usually the soluble salts of the soil, and these are deposited on or near the surface as the water evaporates. In order to avoid these results, it is necessary, in certain situations, to have a drainage system in connection with the irrigation system. But to establish a proper drainage system requires

the co-operation of many owners, and considerable engineering knowledge, and for this reason the Government experts have taken the matter in hand, and either plan a drainage system in connection with the irrigation system, or give advice as experts when it becomes evident, later on, that drainage is necessary. These experts are now experimenting with alkali lands in irrigation areas with a view to ridding them of excess salts, and excellent results are attending their efforts.

As a result of Government aid and advice in these various matters, the losses to the farmers will be much less in the future than they have been in the past.

COMMUNITY OF SMALL IRRIGATED FARMS IN SOUTHERN CALIFORNIA, WHERE THE ANNUAL INCOME NETS APPROXIMATELY $1000 PER ACRE.

THE THIRD STAGE.

But the construction of irrigation works and the preparation of the land to receive the water are all preliminary to that more interesting question, the selection and cultivation of the living plant; and here, as elsewhere, we find that the Government is able to give us excellent suggestions.

In 1862 and 1890 liberal grants were made to the various states and territories in support of institutions giving instruction in agriculture, and, as a result, there are now sixty-three such institutions, and almost every one of them maintains an agricultural experiment station. The Department of Agriculture supports stations of its own in Alaska,

Hawaii, and Porto Rico, but the home work is carried on mainly by these state institutions with which the Department is in constant communication. It suggests new experiments, co-ordinates the work of all the stations, and in some cases lends them financial aid. In return it gets the results of their investigations, which it publishes along with those of its own stations and of similar institutions abroad. By means of many trials at these stations, it endeavours to ascertain the best treatment for the various kinds of irrigated soils, and to determine the grains, grasses, fruits, and vegetables best adapted to each soil and climate; also the amount of water needed to produce the best results, the time when it should be applied, and the methods of application best suited to different localities and different crops—and through the medium of its widely disseminated bulletins the farmer gets the benefit of all these experiments.

One of the most interesting bureaus of the Department of Agriculture is that of plant industry, the function of which is the study of plant life in all its relations to agriculture. It maintains, among other things, a laboratory for plant-breeding, an experimental garden, and an experimental farm, and one of its many duties is that of selecting and importing new seeds and plants.

Every year America receives many immigrants of one kind or another—human beings, animals, and plants—more than a million in all. Comparatively little care is taken in the selection of the immigrants belonging to the genus homo, but when it comes to animals and plants, especially the latter, a great deal of care is taken to get only the best. To accomplish this the Bureau of Plant Industry keeps a corps of agricultural explorers travelling up and down the world looking for plants superior to those already under cultivation in the United States, or new plants which these experts think would grow there and be profitable. As a rule, about half a dozen new things arrive every day, and with them, or more often preceding them, comes a report explaining their habits and their habitat, so that arrangements may be made for sending these plant immigrants to that part of the country which is most likely to furnish them a congenial home. Upon arrival, they are passed on to the experiment stations of the various states, or are entrusted to expert farmers who may be depended upon to give them proper care and attention.

Among the more successful species that have come from abroad may be mentioned the olive from Southern Europe; the orange from Eastern Brazil; the tomato, the potato, and the Lima bean from Peru; the rhubarb from Central Asia; the celery from Southern Europe; and the asparagus from England.

Among the more successful of the recent introductions into the regions we are considering, is the durum wheat of Southern Europe and Russia, which is found to be very well suited for the dry lands of the

semi-arid states. This is the wheat from which macaroni is made, and the acreage devoted to its cultivation is increasing so rapidly that the hopeful American expects before long to be shipping macaroni to Italy.

A hardy Swedish oat capable of resisting a great amount of drought has been established in Montana, the Dakotas, and neighbouring districts, and is giving excellent yields.

The Vladimir cherry and forms of the Siberian crab-apple have been brought from Siberia, and introduced into the cold regions of the north-west.

Alfalfa is another of the successful immigrants. Varieties have been found that withstand the rigorous winters of the north-western prairie states; other varieties have been found in the alkali districts of Algeria and Turkestan, and these are being cultivated in similar districts in the south-west, and it is expected that large areas now useless on account of excess alkali will be reclaimed.

For the fertile oases that irrigation is creating in the lower Colorado desert, many things are being imported. Berseem, a variety of clover, from Egypt, the fig-tree from Smyrna, and many varieties of date palm from Egypt and from the oasis of Biskra, in Sahara. A species of alfalfa has been found which, on these rich slopes, yields six or seven crops in the course of the year, aggregating from 10 to 15 tons per acre.

Much of this "Great American Desert" is to be reclaimed, but it is not by irrigation alone that this will be brought about, but by the introduction of hardy plants that have proven themselves able to hold their own against the desert in other parts of the world, and by the careful breeding and nourishing of these plants so that they will be able to do even more in America than they have done elsewhere.

Not many years ago much of this vast region was a grazing-ground for millions of buffalo, deer, and antelope, and a hunting-ground for those wild children of the plain—the Indians; but the white man came, the ambitious white man, and in a little while nearly all forms of the old animal life had disappeared. They were succeeded by a creature a little less wild and a little less attractive, but still attractive, the cow-boy; and now he is almost extinct, and is being supplanted by that very tame and very prosaic individual, the man with the hoe. Those of us who had the good fortune to see something of that freer and wilder and more generous life of the plains before the advent of the irrigating ditch, find in the recent and prospective changes much to be regretted. But, on the other hand, much has been gained; the productivity of tillable areas has been greatly increased; desert stretches have been converted into fields of waving grain, and millions have been added to the taxable wealth of the nation. In view of all this, I think we should be content.

Before the paper, the President: I have to introduce to you to-night the reader of the paper, Major Beacom, who is military attaché to the United States embassy.

Our Society has always maintained close relations with both the naval and military members of that embassy, which has been fortunate in obtaining a succession of able men to fill those posts. Major Beacom has had the advantage—a great advantage to all geographers—of seeing active service outside his own country in the Philippines, and he has always taken a great interest in this question of irrigation. He will give you to night what I know to be a most interesting account of the effects produced by irrigation on those arid regions of the Western United States, which were in former days regarded as irreclaimable deserts. The subject is one of high interest to all geographers, but it is, I think, of special interest to us, because it is a question which largely affects the future of considerable portions of the British Empire. An immense work in this direction has been done, as we all know, in India, which fortunately possesses a government independent of the struggles of parties, and so has been able to conduct its work efficiently. Much has also been done in Australia, where our colonial brothers are free from the fetters of mediæval modes of thought. So again, as we all know, the ancient irrigation of Egypt has been vastly extended under the wise autocracy of Lord Cromer. But there is one part of the British Empire where not only the economic future, but also the political future, depends largely on the thoroughness with which a policy of irrigation is carried out. I am referring, of course, to the new colonies of the Transvaal and the Orange River Colony, to which must be added a considerable portion of Cape Colony. Our own rulers at home have not carried out any very lasting or consistent policy with regard to this matter, and this is not surprising when one considers the feeling of almost disdain that so many people in this country, otherwise highly educated, have for geography; for I need not point out to you that irrigation over vast regions is strictly a geographical question, depending as it does upon the morphology of the country, on the political conditions, and on the nature of the soil. I think that it will be very agreeable to hear a paper on this subject delivered by a citizen of a very go-ahead and progressive country, in which geography is considered to be a proper subject for the education of youth. I will now call upon Major Beacom to read his paper.

After the paper, the PRESIDENT: I think we must open the discussion by calling upon Sir Colin Scott-Moncrieff to say a few words. He is, as you know, not only the highest autherity in India, but the highest authority in Europe on the question of irrigation in many parts of the world.

Sir COLIN SCOTT-MONCRIEFF: May I be allowed first to say what pleasure I have in welcoming a brother officer from the American corps of Engineers in this country? I am sure my brother Engineers present will join me in saying so. Major Beacom has given us a most interesting lecture. One little thing he remarked was curiously unlike my own experience: he said parts of the Colorado had reminded him of the Nile in Egypt. Now, it struck me the whole position was as unlike the Nile as anything I had ever seen, not only as regards the country, but among the *genus homo* to whom he alluded. As I listened to page after page with great interest, I kept asking myself questions which I would like to ask the lecturer; but if I asked them all it would keep you here at least till midnight. He told us a great deal; but he knows, as well as any one else, that there was a great deal he had not time to tell us. I would like to ask where all this great water-supply comes from; whether it is a certain supply or not; whether in that country they have great famines owing to drought, such as we have in India; and whether they raise grain at all without irrigation? In Egypt there is no halfway house; there is merely irrigation or the desert. Major Beacom alluded to the small area of land that was irrigated in Egypt; but it is all there is of Egypt—there is no land there that is not irrigated. The country of Egypt is about one and a half

times the size of Wales. It would take eight Egypts to make Great Britain, and out of that you cannot make a large field for irrigation. When I talk about Egypt I do not mean the desert on the two sides, because they are no more Egypt than the sea is. In Egypt everything is grown by irrigation, because there is practically no rainfall to speak of. Therefore, you cannot have famines from want of rain, and there is no famine so long as the Nile is properly managed. In India it is very, very different. There is a certain amount of rainfall, which is all that a great part of the country has to depend upon; and it is sufficient for the commoner style of crops, but not for the more valuable ones. And there irrigation comes in; and then the question comes, How much water is there, and can you count upon it? In Northern India there is a great ice-wall, and the hotter the day the more the melted ice comes down, rolling over the country. Further south there are large reservoirs, great lakes doing valuable work; but when the rains fall, as they sometimes do, these lakes are empty. I remember having experience of it in 1877, in a beautiful fertile province, Mysore, where the reservoirs number some 30,000, I believe, and there was not a drop of rain in one of them. I do not know if in America that kind of thing can happen; whether the rivers ever fall short of water, or whether there is a constant supply. Reservoirs go a long way, but any scheme of irrigation requires a large volume of water. You will be perhaps surprised to hear that a million cubic feet of water will not keep more than about 7 acres of rice alive. One great point we always have to consider with regard to an irrigation officer in India, is what use he makes of his water. An officer is put in charge of a certain amount of water, and he is asked, "How many acres have you irrigated out of it?" He keeps an exact account of the volume of water that enters and the quantity that leaves his division, and he has to send in an account showing that so many cubic feet of water have irrigated so much land. I do not know whether it has come to that, or whether there is the necessity for it, in America. If there is plenty of water, there is no great need to trouble about it. Major Beacom alluded to the large area—45,000,000 of acres—in British India. I should say that of that 45,000,000, 13,000,000 are irrigated from wells. These wells are made by the private farmers and peasants; they are often merely holes cut in the ground down to the spring-level. Sometimes—not in most cases—they are lined with masonry. The Government has nothing to do with them, but it gives a man an advance to help him to dig a well, and it is afterwards entirely his own; and for this irrigation the Government can take no credit. What has been done by Government is not much more than 30,000,000 acres. I believe there is going to be a great deal more. I was struck, but not more than I expected to be, with the courage and with the magnificent engineering works of the American engineers. The difficulties they have had to face were enormous, and the works are evidently of a very high order. One would like to hear a great deal more about them, and, of course, most of all to visit them. One great difficulty that exists in India is the soil. A large portion of the country is composed of what is known as "black cotton soil;" it is very clayey, and a very small amount of rain will produce a crop. Very much rain will make a quagmire, and you can get nothing much out of it; but with moderate rain it is especially good for cotton. My chief business in India for many years was considering the question of irrigation always from the point of view of the prevention of famine, and, coming to a district of black cotton soil, the people would come and say, "For Heaven's sake, don't send your water here." And that would go on for perhaps ten years, and then they would come and go down on their knees, and say, "For goodness' sake, give us water." The difficulty is the financial question, because if people only want water once in ten years, you cannot see how to charge them. My experience of

irrigation has always been with subject people, either the natives of India or the natives of Egypt, and they at least are totally unlike the natives of America. With these subject people there is a strong Government, and you lay down rules which the people must obey. For instance, a distributing channel delivers water to the first 3 miles on Monday, Tuesday, and Wednesday, and to the next 6 miles on the other half of the week. The irrigator has a little earthen pipe inside the channel from which he draws his water, and if he is caught irrigating his crop on one of the days on which it ought not to be irrigated, he is fined; and this law they can keep pretty well enforced. I do not know that the American farmer would be as amenable to reason if he saw his crop dying? I do not want to say anything against Boer farmers, but from what one has read, I do not think they are very good at obeying the law. The conditions with regard to water in the Transvaal are very curious. It is a limestone formation, and there seems to be a regular network of rivers or branches of rivers some 40 or 50 feet below the ground. A farmer sinks a well, starts a pump, and he may pump dry a dozen farms all round him. While he is injuring the neighbours, he may have far more water than he wants for himself; but he says, "I bored the well, and I am entitled to all the water." Laws must be made for such cases as this, and these laws must be rigorously enforced. The most law-abiding and the most scientific irrigators I know are in North Italy; they have had irrigation from the time of Leonardo da Vinci. They have a beautiful system of canals, and there the farmers are law-abiding; and I have been told it is considered as disgraceful to take water out of your turn as to steal a horse out of a stable. I hope it may be the same in America. I was much interested in the efforts that are being made in America to study agriculture and see what is best for the different soils. I am sorry to say we are very much behindhand in that respect, both in India and in Egypt. The total initial cost of these American projects, we are told by Major Beacom, is from £4 to £17 per acre. In India the average is about £3 5s. per acre, but there are no works like these tremendous works we have seen photographs of to-night.

The President: I will now call upon Prof. Gregory, who, during his long experience in Australia, must have gained a great deal of information connected with the irrigation there.

Prof. Gregory: I should like to join Sir Colin Scott-Moncrieff in expressing the high appreciation in which the work of the Irrigation Department of the United States is held in other countries. The great collection of data obtained by that department, not only throws light on many problems of high theoretical interest, but is of great practical value to those who in other countries are wrestling with drought, and trying to stay the deplorable waste of water in times of flood. We must thank Major Beacom for his interesting account of the work at present in progress in the United States. It is interesting to observe in how many respects Australia and America are developing their irrigation schemes on parallel lines; sometimes the one state and sometimes the other is the pioneer. The United States is, of course, working on much greater lines; but its Reclamation Act, providing for great national schemes, conducted by a branch of the Geological Survey of the United States, follows the much earlier example of Victoria, where the great reservoirs and long water-channels are all State works, made and managed by a branch of the Mines Department. So far as Australian practice is concerned, there seem to be three main requirements in successful irrigation: the water is wanted at the right season, and, as Sir Colin Scott-Moncrieff pointed out, a great deal of it is wanted; the population should be concentrated, at least locally; and there must be a considerable population of painstaking and careful farmers. Irrigation work has the great advantage that a desert soil is, in most cases, a fertile soil. There are, of

course, exceptions; but in the majority of cases the old desert soils have stored up such accumulations of plant food that they only want water to grow luxuriant crops. The Milk river controversy is analogous to that between three Australian states over the Murray. South Australia contributes nothing to the waters of the Murray river, all of which comes from New South Wales and Victoria. Canada may get some encouragement from the Australian decision, as the two states that supply the water agree to allow South Australia a very considerable share of it.

The PRESIDENT: I will ask Mr. Colquhoun if he will say a few words. He is an old South African, and knows large parts of the world.

Mr. COLQUHOUN: The subject of the paper read this evening is one that is of special interest to myself, although I have not had the opportunity of personally visiting these irrigation works of which Major Beacom has given us so interesting an account. There is, perhaps, no more eloquent tribute to the energy and enterprise of the American people than these irrigation works, and it is wonderful to-day to realize that the enormous areas of land, which not very many years ago were wild and almost trackless, are now so fully peopled and so far developed, that it is necessary to begin the undertaking of these reclamation schemes with a view to intensive cultivation later on. The special point to which I venture to call your attention this evening, is one which came under my notice in South Africa in connection with this question of irrigation. Major Beacom has incidentally referred to the great difficulties that arise from the existence of water rights in old countries; but he has not said so very much on this particular subject, because in new regions, such as the one he has been treating of, these difficulties are not accentuated in the same way as they are in the older and more peopled countries. In Italy, as Sir Colin Scott-Moncrieff has partly indicated, this particular difficulty (which was very acute indeed, arising from the conflicting interests of that country) was met by what may be briefly called the nationalization of the water rights, and, in the opinion of many people who know South Africa, it will be necessary for that country to follow the example of Italy, if the full possibilities of South Africa as an agricultural country are ever to be realized. The United States are to be congratulated on having such a wonderful organization—an organization which combines so complete a scientific study with the practical enterprise which the American people always exhibit. We ourselves in India have a department, as our chairman has told us this evening, which has done not only such wonders for India, but has helped to recreate Egypt, and has sent most distinguished irrigation engineers to nearly all parts of the world to report upon that subject, and Sir Colin Scott-Moncrieff, who is with us this evening, is perhaps the most distinguished of these engineers. But there are two countries within the British Empire, one South Africa, and the other Australia: South Africa, which has hardly begun to think of irrigation; Australia, which has done something, but by no means what ought to have been done for that great country—these two seem still not to realize the value of really scientific irrigation. It is, therefore, of the greatest value to us, and fraught with interest also, to hear of the methods which are being adopted in the United States, where scientific study is so happily combined with practical energy and enterprise. And I hope that our young democracies overseas, those within the British Empire, may see their way to follow the example of our American cousins in this respect, if not perhaps in all others.

Mr. BUCKLEY: At this late hour I feel I must not detain you long, but I should like, in concert with Sir Colin Scott-Moncrieff, to congratulate Major Beacom and the Engineers of America on the great progress they are making in the science to which so many of us in India have devoted our lives. Major Beacom referred to the great Colorado river, and there is one point in connection with that which may be of some

interest to the meeting. The great Colorado river carries down, Major Beacom told us, 1,500,000 tons of silt every day in a great flood. Now, perhaps you will all think that this mud in the water is not a very important matter. I assure you that it is important. In India it is a common thing to see a cultivator, who has got his ricefield filled up by the rain, deliberately letting off the rain-water, and then, when the field is dry, allowing the canal water to flow over it again. You ask him why he does it. He tells you it is because he gets fertilizing silt from the water. It is the fertilizing silt which has made Egypt so fertile, and it is fertilizing silt which will keep the Colorado claims productive. I heard the other day that a large number of American farmers were leaving America and going to Canada. I asked why it was, and I was told they were leaving America because their lands were becoming exhausted, and they were going to the virgin soil of Canada, where they could grow the good crops they used to get in America. Now, if the lands under irrigation in Colorado are to be productive, you must do the best you can to transfer the silt from the river on to the lands. Major Beacom said he was not aware what the volume of silt was that passed down the Nile. I happen to know the figures. Sir William Wilcox gives the proportion of silt in the river, and I find that about the same quantity of silt passes down the Nile in a big flood as comes down the Colorado; that is, the maximum of any day of the year is about the same, but the Colorado carries rather more than the Nile.

The total quantity of silt which passes down the Nile during a whole year is given by Sir William Wilcox in his book as 47,000,000 cubic yards. I dare say these figures convey to you very little impression of the volume. You know Hyde Park and Kensington Gardens. The houses all round them are about 50 feet high. Now, suppose you filled the whole of Hyde Park and Kensington Gardens up to the top of the present houses with mud from the Nile, and then, on the top of the present houses you built another lot of houses 50 feet high, and still a third lot of houses 50 feet high on the top of the second lot, and then filled up the whole area to the top of the third set of houses, the quantity you would absorb would be about the volume of mud which comes down the Nile in a year. A large portion of this silt is spread over the land in Egypt, and it is to that that the land owes its fertility. I feel a little doubt whether, if these irrigated lands in Colorado have to depend largely upon reservoirs, they will retain their fertility; for, mark you, when you put water into a reservoir and keep it there a long time, all the fertilizing matter which ought to go on to the land, or a very large proportion of it, sinks to the bottom of the reservoir; you do not get it on your fields, and you choke your reservoirs with it. I think the American Engineers will have to consider whether some measures are not necessary to enable them to pass the silt which the Colorado river carries on to the lands, so that they may keep them up to their present standard of fertility. There are other points to which I should like to refer, but I feel I should not detain you longer. I will, therefore, only thank you for your kind attention.

Colonel Church: In answer to the gentleman who has just spoken, may I say a word with reference to the silt question. The engineers of Canada tell me that there are 70,000,000 of acres of arid and semi-arid lands which can be irrigated there. If it is necessary to have silt to fertilize, for instance, a wheat-field, why is it that the further you go north the more bushels of wheat you get to the acre of land which is not irrigated? The reason is, that up to the limit of the wheat belt, the ground freezes to a depth of at least 5 or 6 feet. When the wheat begins to spring above the ground it is in the warm weather, when evaporation is constantly taking place, in a very gentle way, from that great ice-cap that underlies the soil. There is no silt in it. It is about the purest water you can get, and yet it will give you twenty-two bushels of wheat to the acre, while if you go south, to the border of

the United States, you get from eleven to thirteen bushels. Therefore, although the silt may be very useful, clear water may also be desirable. I may say that the largest and most beautifully irrigated field I ever saw in my life was in Northern Mexico, which was irrigated by a perfectly clear-water stream. It was growing Indian corn 10 and 11 feet high, with ears of maize nearly as big as my forearm. Is the silt question the main one in irrigation?

I may say something about my favourite Spanish-American country. If you follow that great arid region of the western United States (with its sixteen states) further south, on to the Mexican plateau, varying in elevation from 3000 to 4000 feet in the north to 7500 feet at the city of Mexico, you get a vast area which can be made into a garden wherever you can find water to put upon it, and the chances are that, in nine cases out of ten, if you get any river at all, it will be a clear-water one; and, as a general rule, wherever you see irrigation there, as I have seen it extensively, you will find it is from clear water. If you go still further south, to the tableland of the Andes, and their western slope, I can point there to the remains of irrigation works so extensive that it amuses me to hear about modern irrigation, and of the 5,500,000 acres of Egypt and the 9,000,000 of acres which, perhaps, were irrigated in the palmy days of the Chaldean empire! The ancient Peruvians also irrigated by the millions of acres, and you will find in Peru and Bolivia works absolutely tunneling the shoulders of the mountains. There are on the western slopes of the Andes sixty torrential clear-water streams which can be impounded and utilized as they were in the time of the Incas, and 50,000,000 of acres of land awaiting irrigation. The Peruvian engineers estimate that, even in a moderate way, they might irrigate 3½ millions of acres in Peru alone. When it rains there, as it does once in a long period of years, it is perfectly wonderful to see one of the coast deserts. In the course of a day or two it becomes a vast garden of flowers, great numbers of which are of unknown species, a vegetation which is absolutely marvellous in its appearance, a smile from Pleistocene times. And the next day you look, and it is gone; the arid region has reclaimed it again, and the rains, which have not carried a particle of silt, have disappeared.

The PRESIDENT: Unless any one else wishes to take part in the discussion, I am sure you will join with me in a very hearty vote of thanks to Major Beacom for coming here and giving us such an interesting address, and helping us to pass a very instructive evening.

Major BEACOM, in responding, said: I wish to assure my audience, in the beginning, that I shall not attempt to answer the many questions that have been asked, as that would take too much of your time, but I shall try and answer a few of them.

As to the amount of water in the arid states available for irrigation purposes, I would say that it is not sufficient for more than a small part of the vast region that would be benefited by irrigation; but it is proposed to make the most of existing supplies by increased economy in the use of water, and also to increase the supply, or at least to secure a steadier stream-flow, by preserving the forests on the headwaters of irrigation streams. The Government forest reserves now cover an area about equal to that of the British Isles.

Some exception has been taken to my comparison between the Nile and the Colorado, but I still think that the conditions, from an irrigation point of view, in the lower Colorado and the lower Nile are very much alike. The analysis of the soils shows them to be almost identical, and in the matter of rainfall and temperature there is very little difference. The proof of this similarity of conditions is found in the fact that most things that grow in Egypt can be grown as well in the lower Colorado.

I am not prepared to answer the question, "How are you going to train your

people to wait patiently for much-needed water until their neighbours' crops have been watered, as is often necessary?" We know that there are many difficulties in the way, and we have already sent experts over the world to study the systems of management found workable in other countries. We have concluded that there is nothing to be learned from India or Egypt, because the social and economic conditions in those countries are totally different from our own, but we hope to profit from the experience of the communities of Northern Italy, where the conditions are more like those in America. We are just making a beginning.

I would say, in conclusion, as it may be of interest to you to know, that President Roosevelt did much to secure the passage of the Reclamation Act—so much, indeed, that he may properly be considered the author of that important law.

A NEW ISLAND IN THE BAY OF BENGAL.*

By Lieut. E. J. HEADLAM, R.I.M. Survey of India.

HOPING that it may be of interest, I beg herewith to send a sketch, with a couple of plans and some photographs, together with this short account of a new island which was thrown up by the action of a mud volcano, in the Bay of Bengal, off the north-west corner of Cheduba island, on the Arakau coast of Burma, December 15, 1906.

The island is situated in lat. 19° 0′ 6″ N., long. 93° 24′ 20″ E., and is $8\frac{3}{4}$ miles in a north-west by north direction from the north-westernmost point of Cheduba island. It is in extent 307 yards long in its greatest length running south-south-west and north-north-east, and is 217 yards at its greatest breadth running in a north-west and south-easterly direction; the highest point is 19 feet above high-water mark, and it is entirely composed of mud, with a small quantity of stones of various sorts, but no lava.

On December 15, 1906, the workmen employed by the Public Works Department of Burma in constructing a lighthouse on Beacon island (which lies south-east by south about $4\frac{1}{2}$ miles from the new island) heard loud rumblings and rushing noises, and noticed that the sea was in a much disturbed condition to the north-westward; finally they saw a mass of land appear above the water. This, according to their account, twice disappeared and reappeared again; but this was probably only an optical illusion owing to the wave which was caused by the great displacement of water, which rose several feet above the normal, and probably washed almost over the island.

On December 20, on receiving the information from Mr. Dawson of the P.W.D., who had been on Beacon island, Colonel Huddleston, R.I.M. port officer of Akyab, visited the island, and found it still very soft and hot, but not in any way active. On December 30 the R.I.M.S. *Investigator*, under the command of Commander W. G. Beauchamp, R.I.M.

* Research Department, February, 1907. The discussion on this paper will be published with that on Mr. Sivewright's paper on the "Cutch and the Ran," which was read at the same time.

surveyor in charge of the Marine Survey of India (which was at the time in Akyab), received orders from the Government of India to proceed to the island for the purposes of scientific inquiry, and to fix its position and ascertain whether any further disturbance had occurred in the nature of the bottom of the sea in the vicinity. The *Investigator* arrived off the island on the morning of December 31, and anchored in 11 fathoms just over half a mile from the beach, having encountered no shoal water. Under orders from Commander Beauchamp, I landed, taking with me Captain R. E. Lloyd, Indian Medical Service, surgeon-naturalist to the Government of India in the Marine Survey of India, and two officers of the Marine Survey.

The island, on approaching from the eastward, presented a long low appearance of a uniform greyish-brown colour, having a small knob or summit on its southern end; no smoke or sign of activity was noticed; from a distance of half a mile the water shoaled gradually to the beach. On landing, we found the upper crust quite hard and cool, except quite close to the beach, where the mud was soft—so soft in places that we sank above our knees. The whole island was, with the exception of a small

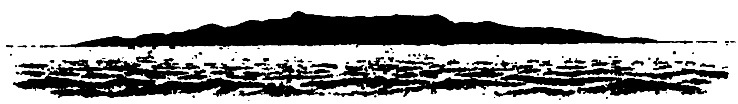


FIG. 1.—GENERAL APPEARANCE OF THE ISLAND ON APPROACHING FROM THE EASTWARD AT A DISTANCE OF ABOUT HALF A MILE.

quantity of stones and sand, entirely composed of greyish-brown mud of a clayey nature, with an extraordinarily rough surface, caused by the quickness with which the boiling mud had cooled with exposure and the cessation of the eruption. The island is a rough diamond in shape, as shown in Fig. 2, with the highest part at the southern end, and extending in a ridge formation in a north-north-easterly direction, with small gullies and ridges branching off at either side. The main ridge is about 16 feet above high water (with the exception of the knob at the southern end), and is about 40 yards broad; the land then slopes down to the sea, being slightly steeper on the western side.

There was no activity visible except at the northern end, where several small craters, varying in size from 1 to 6 feet in diameter, were exuding liquid mud, but only in small quantities and not with any great violence. I computed that the whole output during the day I spent there would not exceed 2 tons. Except in the active area, the whole surface of the island was cool, the temperature of the mud in the shade being 86° Fahr., or normal for these latitudes at this time of year; below the surface I found that the greatest heat was at the extreme summit, which I imagine to have been the main crater, though now filled up. The result of several observations gave a mean temperature on the major portion of the island of, at 2 feet below the

surface, 96° Fahr., and at 8 feet below, 104° Fahr.: whereas at the summit the temperature 1 foot below the surface was 104° Fahr.; 2 feet

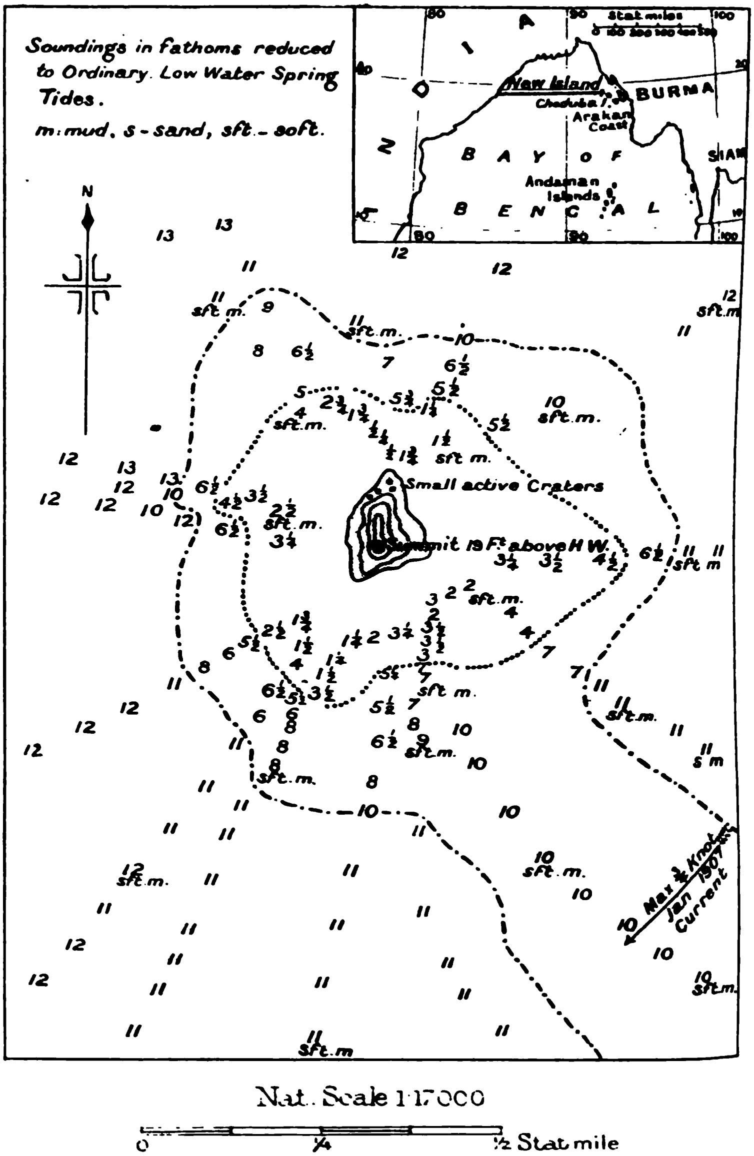


FIG. 2.—NEW ISLAND, BAY OF BENGAL.

below, 108° Fahr.; 3 feet below, 138° Fahr.; and 3 feet 6 inches below, 148°. The whole island gave out a strong smell of sulphur, which was almost overpowering close to the holes bored for taking the temperatures.

A good deal of driftwood had been washed up during the fortnight that the island had been in existence, and Captain Lloyd discovered fifteen varieties of seeds and pods which had already found their way there, blown, or washed up, or deposited by birds that had already commenced to utilize the island as a resting-place. The discovery of such a number of seeds gives a good idea of what a very short time it would take for vegetation to grow on an island of this description situated not many miles from the mainland. At the summit of the island a few bones and remnants of fish were found, evidently left by birds. A large fish-eagle was hovering over the island during part of the time we were on shore, evidently only waiting for us to take our departure before he landed to deposit the large fish he was carrying. Amongst the stones found were small portions of granite and sandstone.

During the time I was on the island two steam cutters were employed, under surveying officers, sounding round the island, to ascertain how far the shoal water extended, and whether any other shoals had formed, but nothing outside the island itself was found. Discoloured water off the island we had noticed from the *Investigator*, which looked like shoal water, was due entirely to the washing away of mud from the island, caused by the sea breaking round its edges. The island rises gradually from a depth of 11 fathoms, the diameter at the base being a little over half a mile, beyond which the depth was found to be as shown in the Admiralty chart, No. 832, of "Cheduka Straits," surveyed in 1884. On Fig. 2 will be found the soundings obtained immediately round the island reduced to low water springs; and in Fig. 3 the island is shown in section north and south, indicating the gradual rise from the bottom of the sea.

At this early date it is hard to say whether the island is likely to remain as a permanency, being composed almost entirely of mud, only 20 feet above high water at its summit, and fully exposed to the force of the south-west monsoon. I should imagine it might wash away and remain

FIG. 3.—THE VOLCANO IN SECTION, NORTH AND SOUTH.

only as a shoal, unless in the intervening five months of fine weather enough driftwood and sand with small stones have formed a secure beach, and grass and young shrubs helped, with the hardening clay of the interior, to bind the whole sufficiently together to withstand the force of the sea and rain in the monsoon.

A study of this portion of the Burma coast seems to show that this island is part of a chain of mud volcanoes which appear along the eastern side of Cheduka island and the islands immediately to the southward, some of which are several hundred feet in height and are occasionally active; and again continuing the line for some 50 miles further to the

FIG. 4.—WATCHING THE LIQUID MUD EXUDING FROM SMALL CRATER. DISTINCT RUMBLINGS WERE HEARD.

northward, we came to another mud volcano (active, but still some feet below the surface of the sea), which is situated just inside the southern point of the Eastern Borongo, about 20 miles south of Akyal, and which was discovered by the officers of the R.I.M.S. *Investigator* whilst surveying there four years ago.

The photographs give a very good idea of the extraordinary roughness of the ground, and of the liquid mud as it poured down from the small active craters. The beacon and flag on the summit were erected as a mark to help in fixing the position, and also to draw the attention of passing ships to this uncharted danger, which, on account of its lowness and drab colour, is very difficult to see until fairly close, more especially in misty weather. The photographs were very kindly

FIG. 5.—WATCHING THE ACTION OF AN ACTIVE CRATER. THE BROAD STREAM OF LIQUID MUD IS EASILY NOTICEABLE FLOWING AWAY FROM THE CRATER.

FIG. 6.—GENERAL VIEW OF SOUTHERN END OF ISLAND, WITH SUMMIT (OR MAIN CRATER), AND BEACON FLAG ERECTED TO WARN VESSELS.

presented to me by Assistant-Engineer Hindman, R.I.M., who landed with me and took them.

SOME NOTES ON THE SAN FRANCISCO EARTHQUAKE.

By JACQUES W. REDWAY.

THROUGH the researches of the State (California) Earthquake Commission, much interesting knowledge concerning the immediate cause of the earthshock in the vicinity of San Francisco has been brought to light. The geological and tectonic investigation was assigned to Prof. George Davidson, F.R.G.S., well known as an authority in both geology and geodesy. Prof. Davidson adopted the practical plan of sending out some very bright and enthusiastic young men with cameras and surveyor's tapes, and probably no earthquake has ever occurred the facts and effects of which have been more carefully observed. I have had the pleasure of studying the records obtained by two observers—Mr. R. S. Holway, of the University of California, and Mr. C. T. Wright, of the Redlands High School, each in the department of Geography. I also was enabled to compare my own experiences at the time of the great shock of 1868 with the experiences of those who suffered the shock of April 18, 1906.

The city of San Francisco is situated on a peninsula that is essentially a much-fractured block of the coast ranges. The ridge in question is probably post-Jurassic—possibly early Cretaceous. Cherts, sandstones, and schists, with here and there intercalated lava-flows, compose the rocks of the block. The strata are much disturbed; in various places the angle of tilting is 50°, 60°, and 70° or more.

The faulting of the block is also extensive. A profile on a line extending north-east and south-west through the middle of the penin-

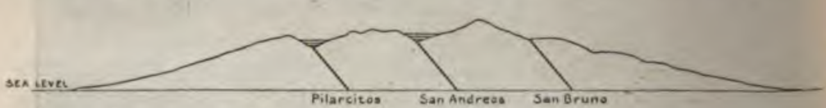


FIG. 1.—AN IDEAL PROFILE ACROSS SAN FRANCISCO PENINSULA, SHOWING THE PRINCIPAL FAULTS AND THE INTERRUPTED DRAINAGE.

sula would show, at the least, half a dozen faults. Three of them, charted on the accompanying map, are bold and extensive, and an ideal (not actual) profile is illustrated in Fig. 1. The aggregate amount of displacement is estimated at several thousand feet. The interference with the former drainage slopes is evident from the fact that numerous small lakes have been formed along the lines of faulting.

The earthquake of 1906 was thought at first to be due to a movement along the line of the San Bruno fault, but closer investigations have proved that the disturbance was chiefly along the San Andreas fault (see map). Possibly both faults were involved. The rift made by the earth-movement is traceable along or near the dotted line of the fault (see map), a distance of about 50 miles. In loose soil it appears usually as the hillside of a furrow; in hard earth as cracks, crevices.

SAN FRANCISCO AND NEIGHBOURHOOD, SHOWING PRINCIPAL FAULTS.

Mr. Holway describes the appearance of the disturbed rock-waste in Fig. 2 as "plowed land."

So far as I was able to learn, the vertical displacement did not exceed 3 or 4 feet in any locality; throughout the greater extent of the rift it was not more than a few inches with regard to the

relative position of the two sides of the rift. This is shown in all of the photographs; the relative level is preserved.

The lateral shift is shown actually in the photographs Figs. 3, 4, and 5. In Fig. 3 there is no vertical displacement, as at first appears; on the contrary, there was merely a shearing of the bank of earth, one side being driven forward. The man at the right hand stands at a point in the former line of the fence; on the left, Mr. Holway's position marks the line to which the broken end of the fence was shifted—a distance of 15 feet 6 inches. The short section of fence against which he is leaning was built after the shock, in order to close the gap. A similar displacement is shown in Fig. 4. This photograph was taken by Mr. Wright, and the locality is about 30 miles from that of Fig. 3; the amount of displacement may be judged from the photograph. Fig. 5 is from a photograph taken near St. Reyes, and is a most interesting exhibit. The road was formerly straight; the "plowing" is here very evident, and it covers a width marked by the distance between the men in the middle and the background. The lateral displacement is about 16 feet. Before the shock the road was straight; the two ends of the fracture now are not even in alignment.

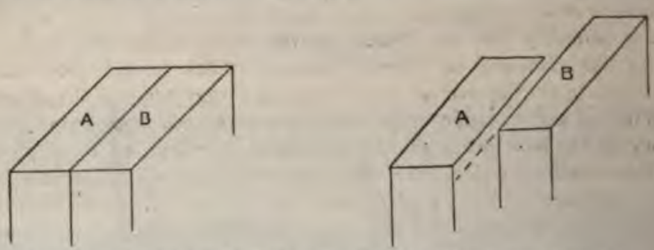


FIG. 6.—DIAGRAM ILLUSTRATING THE LATERAL DISPLACEMENT OF BLOCKS.

The question concerning the visibility of the earth-wave itself seems to be as uncertain now as it was in the case of the shock of 1868. The following phenomena have been observed, however, beyond doubt:—

Columns of dust shot upwards at the instant of the passage of the earthwave.

The violent vibration of trees and buildings caused by the passage of the wave.

From an economic standpoint, there is no question concerning the superior stability of steel buildings; but few of them were materially damaged by the shock.

The damage resulting from the earthquake was not great; 95 per cent. resulted from the fire. The chief mains crossed the fault, and the shearing of them rendered the control of the conflagration an impossibility.

SURYEYS IN INDIA AND IN EGYPT.

The Indian Survey Report for the year 1904–1905 commences with an interesting summary of the recommendations of the late Special Survey Committee (a subject to which reference has already been made in the *Journal*), and *inter alia* repeats in more official form the substance of Colonel Longe's letter in the recent February issue. The recommendation in favour of a uniform one-inch topographical map of the whole of India, which is essentially military in its inception, is apparently framed on a curiously low estimate of the value of the topographical mapping on various scales already published, which leaves little of the Indian peninsular area untouched; and on a high estimate (almost equally remarkable) of the value for military purposes of uniformly accurate one-inch mapping over vast areas where no military movement ever has, or ever will, take place. The "whole of India" is a very large area to deal with, and we agree with the statement of the Surveyor-General that, with more than half a million of square miles of original survey, and nearly half a million of resurvey, to be made within twenty-five years, the present staff of the department is quite inadequate. The decrees of the Indian Government, however (especially as regards the Survey department), are not as the laws of the Medes and Persians, for they change with almost periodic certainty; and when the resurvey of, say, the deserts of Rajputana or the jungles of the Godavari basin are once again to be subjected to the process of accurate and systematic plane-tabling on the one-inch scale, based on close triangulation, there will doubtless be a reconsideration of the recommendations of the committee.

This is presumably the last Indian Survey report which will include the operations of the Cadastral and Forest branches, which absorb about half the working strength of the department. In future the survey is to deal almost entirely with topographical and scientific issues, and it is a matter of congratulation that the scientific branch has been left practically uncrippled by reform to carry out those important investigations which have been conducted lately with so much success under Colonel Burrard. There is, indeed, only one trigonometrical party in the field working on geodetic lines, and to that one is entrusted the unenviable task of carrying triangulation westward through Baluchistan; but the tidal and levelling, the magnetic, the pendulum, and the astronomical parties have all of them many important observations yet to make before they can bring their operations to a close without losing the necessary continuity in the general scheme of action.

The topographical and geographical outturn for the year under review amounts to a very considerable figure. In Tibet, Seistan, and Somaliland nearly 100,000 square miles of geographical survey were covered, besides 4000 on the Burmo-Chinese frontier; and the total outturn of accurate detail work was no less than 132,738 square miles. This includes mapping in the Shan States, Burma, Bengal, United Provinces, Punjab, Sind, Baluchistan and the North-West Frontier Province, showing how widely the topographical parties of the Indian Survey are scattered over India.

The story of the reproduction and publication offices in Calcutta is but a continuation of an historical series which recounts the impossibility of dealing with the mass of work thrown on it, departmental and extra-departmental, without an adequate staff to meet it. 95,387 sheets were issued during the year, whilst eleven general maps of India, on scales ranging from 32 to 256 miles per inch, were in hand, as well as seventeen sheets of the map of India and adjacent countries on the 1:1,000,000 scale, fourteen of which were published. Sympathetic reference is made to the loss occasioned to the department by the retirement of Colonels Wahab and Hobday.

The "Narratives"* from which extracts have been taken for publication in the Report before us are those of officers of the Indian Survey Department who are employed on work of scientific investigation. There is little of topographical, and nothing of geographical, interest in them if we except certain results derived from Captain Wood's mission to Nepal. They afford, however, most convincing proof of the strenuous nature of the work of the scientific branch of the department, and should serve amply to justify the maintenance of a well-matured system of scientific investigation in the eyes of those critics who are disposed to assert that India cannot afford to be scientific.

No less than 128 pages out of the 187 which comprise the Report are devoted to the reproduction of tables giving the results of magnetic observations, which are further illustrated by a map showing the stations of observation of the magnetic survey. Since the year 1901 these have been carried practically over the whole peninsular area, with the exception of the Central Provinces. A description of some of the stations and of the instruments used completes the narrative, but no general deductions are made, nor is any indication afforded as to the practical result of these undoubtedly valuable observations.

Major Conyngham's report on the pendulum observations for determining the force of gravity is directly interesting. The latest instrumental equipment for this class of observation includes "half-second" pendulums, which are only quarter the length of those previously used in the department. A new method (an Austrian invention) has also been introduced for registration of the coincidence of beat between the free pendulum and the clock pendulum, the pendulums being no longer swung *in vacuo*. A considerable increase in accuracy of observation has thus been assured, further refinements being introduced in the corrections applied for the minute vibrations (or "wagging") of the stand on which the instrument is fixed, due to the swing of the pendulum. Some of the results are curious. For instance, it was found at Calcutta that the perpetual tremor or vibration, set up by traffic, due to the nature of those alluvial deposits on which the city may be said to be floating, absolutely negatived the value of the observations; whilst, on the other hand, observations taken at Colaba, in Bombay, were not affected appreciably by the firing of the big guns of the fort in their vicinity.

The value of g (force of gravity) being used to determine the figure of the spheroid and the density of the Earth's crust, it was found at Colaba that the excess of attraction indicated by the observations equalled that which would be accounted for by a disc of earth-matter below the instrument 2530 feet thick, with an excess of density equal to 2·8 above the average of surface density. At Dehra Dun, on the other hand, the defect in g indicated a deficiency in density of 2·8 extending to 2930 feet in depth. Assuming that the surface density is 2·8, this means that we must imagine a cavity 2930 feet deep under Dehra Dun. In other words, "the matter underlying Dehra Dun is so deficient in density—we do not know to what depth this deficiency may extend—that it would have to be pressed downwards until the surface of the land was 2930 feet below its present position before it would attain the average density of the crust of the Earth. Likewise at Colaba an expansion of the underlying strata until a hill 2500 feet high had been formed would be requisite to reduce the excessively dense rock that is found here to the average density of 2·8."

Certain levelling operations referred to in another part of the Report have been undertaken in the interests of these pendulum observations to determine the difference of level between Dehra Dun and Mussuri.

* Extracts from Narrative Reports of Officers of the Survey of India for the season 1903–4.

Valuable results still continue to be obtained from the tidal observations, which extend over forty-two ports from Aden to Port Blair. Tide-tables for forty ports are now published in England, based on the observations of the Indian Survey. Several instructive tables will be found in the Report, especially those showing the errors in the predicted times and heights of high and low water at the various stations. These tables apparently indicate a superiority in the automatic system of recording.

Amongst the most interesting records of the season are the results obtained by a careful recomputation of Captain Wood's observations for determining the position of Everest and the other high peaks in Nepal. The more rigorous methods employed give a very slight difference (never amounting to half a second of arc) between the new and old determinations of the co-ordinate values of the stations of observation, which differences are reflected in a greater degree in the values of the peaks observed; but the corrections in altitude of the peaks observed, due to the employment of a revised coefficient for refraction, are more marked. The height of Mount Everest, for instance, is reduced by about 300 feet (28,700 instead of 29,000 feet), and a general reduction in altitude of most of the peaks is apparent. This, however, must not be accepted as the final determination. There are other factors in the computation of altitudes observed under extraordinary conditions still to be determined with more rigorous exactness, and it is quite possible that the ultimate altitude of the highest mountain in the world may be fixed at a higher figure than 29,000 feet rather than a lower one.

A short statement of the progress of topographical surveys in Sind (with no narrative of interest) and of riverain surveys in the Punjab, with a few notes on town and municipal surveys generally, completes the Report.

Turning to the Egyptian record for the same year, we find an equally busy department with an even wider field of investigation. The Egyptian Survey department is the "universal provider" of scientific advice to Egypt. Not only does it concern itself primarily with base line measurements and the extension of geodetic triangulation of the highest class, but it includes the analysis of milk from "the Zoo," though what animal furnished the milk is not stated. It is, in short, just what such a department should be under strict financial management. Nothing is wasted in the administrative staff of geological, meteorological, seismologic, or other scientific offices. All are combined under the practical direction of that most capable officer, Captain Lyons, F.R.S.

The most interesting feature of the report from the geographical point of view is the extension of triangulation up the Nile valley to Wady Halfa. This means that a direct series has been measured through 1050 kilometres of meridian from Egypt as far south as the parallel of 22° N. lat. This triangulation is not geodetic, and consequently, as a series of the second order, cannot take its place directly as part of the great arc series which will eventually extend from Natal to Cairo. But it will assist greatly in facilitating the operations of final measurements of that arc, and it is a most important contribution towards it. The reassessment of the land has created a great demand for triangulation in the delta, which, being a highly developed area, requires the greatest possible accuracy in measurement for cadastral purposes. Very much has been done already towards the attainment of this desideratum. Preliminary work for the commencement of the strictly geodetic triangulation of Egypt has been entered upon, and the hope is expressed that this will eventually be connected with the same class of work in South Africa, and be extended from the North Cape to Greece. "When completed and connected, the combined work will be extended from lat. 34° S. to lat. 70° N., and should greatly add to our information with regard to the form and dimensions of the Earth, a most important and interesting

problem." This is undoubtedly true, but it would perhaps assist more towards the financing of the project if the practical importance of at least one central geodetic chain were insisted on for the purpose of securing as a basis and backbone to all subsequent map-making in Eastern Africa. The determination of the Earth's figure is not the only, nor the most important, aim of this costly and lengthy class of triangulation. The enormous practical value of such a gigantic arc measurement is often apparently overlooked by its scientific advocates.

In this connection there is much interesting information on the subject of base measurements, and the care and labour which has been bestowed on securing the best possible instruments. The Jäderin method of measurement has not proved uniformly successful owing to the want of standardization, and the uncertain tension of the wires, but with the introduction of proper standards for comparison the extra rapidity which can be introduced into the process of base measurement by the use of this apparatus fully ensures its constant application in future. Ten bases were measured, either with the Jäderin or with a 100-metre steel tape, in the Nile series. An 8-inch micrometer theodolite was employed in this series, and the probable error in the observed angles is reckoned at 1·44 seconds.

Topography, lately, has been chiefly confined to compilation from large-scale mapping of the delta area.

In the meteorological and magnetic branches an immense amount of useful work has been done, as also in the geological section; and the river-gauging has resulted in valuable data regarding the Nile water-supply. It has been found, for instance, that the volume of water at Khartum (when the Atbara is not contributing) is greater than it is at Aswan (Assouan). How much of the diminished volume at Aswan is to be attributed to "seepage" (as suggested) is possibly open to question.

On the whole the report is one of which Captain Lyons may well be proud, for it is a great record of a most useful department thoroughly well organized and administered.

T. H. H.

REVIEWS.

EUROPE.

Unconventional Travel.

'A Cruise across Europe.' By Donald Maxwell. London: John Lane. 1907. Size 9 × 5½, pp. 254. *Price* 10*s*. 6*d*. *net*.

This delightful book is the record of a fresh-water voyage across Europe from Holland to the Black sea, in a small barge. The route taken was by way of the Rhine, Main, Ludwig canal, and Danube. Undoubtedly the most interesting part of the journey was the passage of the Frankischer Jura mountains by Charles the Great's Ludwig canal, with its hundred locks, the tolls for which worked out at the enormous sum of six marks for the lot. In this part of their trip the voyagers were literally sailing among the mountain-tops, and the experience was as interesting as it was unusual. The travellers met with numerous adventures, being at one time arrested as spies, and at another mistaken, by the unsophisticated peasants, for pilgrims to the Holy Land; but in spite of everything they safely reached their destination. The book is well written, and the author's really beautiful illustrations greatly add to its interest and attractiveness.

ASIA.

Syrian Sketches.

'The Desert and the Sown.' By Gertrude Lowthian Bell. London: Wm. Heinemann. 1907. *Price* 16*s. net.*

This volume appeals primarily to the human and the antiquarian instincts. Most travellers have suffered at times from their inability to converse easily with the inhabitants of the region they were traversing. Miss Gertrude Bell has the rare qualification of being fluent both in Persian and Arabic. Besides a keen enjoyment of travel, she has a very thorough sympathy with oriental modes of life, thought, and speech. She has, further, a talent for reproducing with convincing and dramatic effect her conversations with her hosts or companions of the road. Consequently, the reader, before he finishes her volume, will know more about Syrian character, the life of the desert and the mountain, than he might gather from half a dozen ordinary travellers' diaries. There may not be much new geography, in the strict sense of the word, in her pages, but they contain most graphic landscapes—pictures of a Syrian spring, its frosts and flowers, of the wide cornlands of the Hauran, the lava labyrinths that have flowed from the dead volcanoes of the Jebel Druz, and the bleak uplands of the valley of the upper Orontes. Miss Bell's Syrian travels extended from Jerusalem to Alexandretta, and led her through many wild districts and to not a few unvisited or little-known sites.

Crossing the Jordan, she journeyed first round the eastern slopes of the Jebel Hauran. In this region, on the edge of the desert, the ancient feud between Druse and Arab runs its perpetual course. Flocks and herds, as in the days of Job, are swept off by Arab marauders; the mountain villagers plan a foray of revenge. The author gives a most picturesque description of how at Salkhad, the old fortress that looks out east over the unbroken plain and the paved Roman highway to the Euphrates, she found herself joining in a moonlight dance of Druzes preliminary to one of these forays.

From Damascus, where Miss Bell saw much of Eastern life, she went north past Baalbek to Homs, Aleppo, and Antioch, visiting on the way many of the wonderful ruins of Roman cities, Christian fifth and sixth century churches, and crusaders' castles, that are scattered over northern Syria, silent witnesses to the extent of ancient civilization and of Mohammedan destruction. Her pages may inform the general reader, to whom the works of De Vogüé and later explorers, German and American, are unknown, of the existence of a classical church architecture, dating from at least A.D. 372, based on the use of the arch, and anticipating in many of its features the Western Romanesque. It was largely employed for domestic as well as for ecclesiastical uses. Combining Roman strength in construction with oriental delicacy in detail, and showing great power of adaptation, it has a dignity and charm which photographs fail adequately to convey. Its full development was cut short by the Arab invasion while it was still a living art, and its relics, scattered over desert lands, impress the traveller with a sense of the impermanence of empires and even of civilization itself.

Miss Bell has added to the catalogue of ancient sites and copied fresh inscriptions. But it is as a living picture of the present state of Syria and a fascinating glimpse into the mind of the East that her book will be most widely read and valued.

The illustrations are numerous and good. In a few instances, however, they seem to have been chosen on the principle "when you have not what you want, use what you have;" and there is consequently a divergence between them and the letterpress. Thus the beautiful temples of Kunawat on the western slope of the

Jebel Druz, visited by Miss Bell in a previous journey, but not described here, are largely depicted. A map which combines much recent topographical work adds value to the volume, which has also a good index. Need its paper have been so heavy and glossy? D. W. F.

Early Cartography of the East.

'Studi Italiani di Filologia Indo-Iranica diretti da Francesco L. Pullé.' Anno 5, vol. 5. La Cartografia antica dell' India. Parte II. Il Medio-evo Europeo e il Primo Rinascimento. Firenze: 1905. *Atlas, separate. Price* 20*s*.

Another instalment of this useful work is cordially to be welcomed. The geographical knowledge of the Middle Ages, especially in relation to India, is here treated in considerable detail, mainly from the cartographical point of view; and illustrations (of somewhat unequal degrees of merit) are given of portions of many of the chief mediæval maps, from the eighth century onwards. The clarified reproductions of the Orient from the *De Statu Saracenorum* of William of Tripoli, from the *Laurentian Portolano* or *Atlante Mediceo*, from the Turin and British Museum *Beatus* maps, from the Paris manuscript of Lambert of St. Omer, and from Henry of Mainz ("Enrico da Magonza"), are deserving of special notice; so is the representation of Dante's conception of the same regions, and the whole treatment of the Catalan Atlas of 1375, especially in comparison with the Catalan maps of Florence and Modena. On the other hand, the treatment of the Albi, Cotton, St. Sever, and Hereford maps, of Guido's design of 1119, and of the Wolfenbüttel manuscript of Lambert of St. Omer (see pp. 8, 11, 18, 22, 39, and *Tavola D*) is not equally successful. Will Count Pullé allow me to beg him, in a second edition, to give references to the manuscript authorities, especially the manuscript designs, here chiefly utilized? Thus on p. 14, 'Il Paradiso al posto dell' India nel cod. del Museo Britannico,' needs supplementing by the proper reference—*Additional MSS., 11,695, fols. 39 v.–40 r.* Again, may I draw his attention to the erroneous spelling, as in Konrad Miller, of *Beaven* for *Bevan*, the vicar of Hay, whose study, conjointly with Phillot, on the Hereford map, has been of service to so many students (see p. 38)? The author will doubtless wish to harmonize the forms *Oderico* and *Odorico* on pp. 52, 53, as they both refer to one and the same Friar Odoric of Pordenone. *Rubrouck*, rather than *Ruysbroek* (p. 47) is surely the proper local form of Rubruquis' name—as the great traveller's origin is pretty certainly not Brabantine, but from the modern French Department of the Nord, and from *Rubrouck*, in the neighbourhood of Hazebrouck.

I cannot follow the author in his *double* Genoese expedition, in connection with the Vivaldi family, of *1281 and 1291* (p. 65), depending as it does upon the full acceptance and stern pressing of every detail in the late and rather doubtful fifteenth-century authority Antoniotto Uso di Mare, who may easily be reconciled with the primary and contemporary witnesses by the admission of some slight inaccuracies. Citations of English should be carefully revised, to avoid passages such as "*Thirt* edition . . . with a *memory* of H. Yule" (p. 112). And would it not be better to quote Luke Wadding's *Annales Minorum* by its proper Latin title, rather than as if it were an Italian work (*Annali dei Minoriti*, p. 93); not to convert the *Fontes Rerum Bohemicarum* into *Fontes Rerum Bohemorum* (p. 94); and to give, for the Catalan Atlas of 1375, its proper numbering in the Bibliotèque Nationale—*Armoire X., No. 11, Espagnol 30*—rather than its place in Morel Fatio's Catalogue (p. 110)? Lastly, I may remark that the oldest mediæval map is not that in the St. Gall Isidore of about 680–700 (p. 5), but is the mosaic design of about 550, portraying parts of Palestine and Egypt with such surprising accuracy, rediscovered in 1896 at Madaba, in Moab.

C. R. B.

AFRICA.

ALGERIA.

'Algiers and Beyond.' By M. W. Hilton-Simpson, F.R.G.S. 32 *Illustrations*. London: Hutchinson & Co. 1906.

This book consists of notes of travel in various parts of eastern Algeria during 1903 and 1905, and is written with the object of inducing more English people to visit comparatively little-known regions of that country. It contains a good deal of useful information, though it is in no sense a substitute for Sir Lambert Playfair's extremely valuable guide, published as one of Murray's handbooks. Mr. Hilton-Simpson writes sensibly on natural history and on the differences between the Berber and Arab inhabitants. Of the Arab husbandman he remarks aptly that prayer seems to be the principal means by which he cultivates his land. It is unfortunate that the French method of spelling native names has been adopted, and that much space is given up to trivialities; nor need the author have made such an open display of his ignorance of and lack of interest in the history and antiquities of Algeria. The illustrations, all from original photographs, are excellent and well chosen.

NORTH AFRICA AFTER HERODOTUS.

'Nordafrika (mit Ausschluss des Nilgebietes) nach Herodot.' Von Richard Neumann. Leipzig: Gustav Uhl (*n.d.*). *Price* 2*m*.

This is a book of value, which will interest alike the geographer, the naturalist, and the anthropologist. Commencing with a study of the climate, fertility, and habitability of North Africa (chap. i.), the author proceeds to deal with the topography and inhabitants of the North African coast (chaps. ii., v.), with the north-west littoral (chap. iii.), with the story of the journey of the young Nasamonians, with the oases more or less clearly noticed by Herodotus, and with the fauna and flora of the coastal, mountainous, and desert zones of North Africa. Herr Neumann is to be congratulated on the care and thoroughness of his Herodotean inquiries, on the manner in which he conducts his researches and presents his results, and, above all, on the valuable matter which he has to offer us—notably, as to ancient marriage customs, styles of armament, methods of fighting, and religious ideas and observances, among the natives of those parts of North Africa which fall within Herodotus' view. The treatment of the Ammon and Aujila oases, of that of the Garamantes, and of the Atlas mountain system, also deserves especial recognition. All students will be grateful to Herr Neumann for his elucidation of Herodotean Africa.

PHYSICAL GEOGRAPHY OF MOROCCO.

'Dans le Bled es Siba. Explorations au Maroc. Mission de Segonzac.' Par Louis Gentil. Masson et C^ie^. Paris: 1906.

THE journeys made by Mr. Gentil in Southern Morocco throw some welcome light both on the structure and topography of the little-known Atlas region. He crossed the High Atlas at four different points—over the Bibwan pass, the Tizi n Test, the Tizi n Takhrat, and the Tizi n Imuras—thus traversing on the southern side the low plain of the Sus, to which the mountains drop in the west, and the plateau draining to the Wady Draa, which flanks them on the east. Mr. Gentil also explored the great *massif* of Sirwa, which divides these two hydrographic basins, while between these different expeditions he spent some time investigating the coastal region south of Mogador. Here the actual littoral consists of a line of sand-dunes 350 to 450 feet high, backed by a resistant Tertiary sandstone plateau with a steep escarpment

coastwards, on the edge of which Mogador is built. The dunes which result from the disintegration of the sandstone by wave-action are moving and spreading inland, except where they are fixed by a vegetation consisting chiefly of a cactus-like species of euphorbia. The plateau provides a somewhat scanty pasture, with only a few patches fit for cultivation owing both to the stony nature of the ground and the scarcity of water, and is thus thinly inhabited. The springs are few in this country, because, although clays of Cretaceous age underlie the sandstone, they are usually deeply buried, and the spring-level or junction of the two formations is seldom exposed. Only in the less dry parts and near the river-valleys is there any tree growth, but forming here a fairly dense forest. Farther inland, between this plateau and the Atlas, lies the region of wider plains and plateaus, formed of horizontally lying clays and limestones of Cretaceous origin, separated by flat-topped ridges, in which lies the city of Marakesh. It is a fertile, well-cultivated, and populous country, with its fields of grain, its olive orchards, its almond trees, and extensive system of irrigation works. The outliers of the Atlas system which bound the plains to the south and east, forming several ridges and valleys parallel to the main axis, are of Cretaceous sandstone capped with Jurassic limestone weathered into sharp peaks and needles, across which the rivers cut in beautifully wooded gorges. But just east of the meridian of Marakesh is a Carboniferous belt which reappears on the southern flank of the Atlas. The existence of this rock in the Eastern Moroccan Atlas was stated by Balansa in 1868. Subsequent investigations have hitherto failed to confirm his statement, but Mr. Gentil has been able to prove its correctness. In the high central region of the Atlas, red sandstone of Permian age and primary black schists play the chief part. These schists are generally unfossiliferous, but were supposed to belong to the Silurian series, and Mr. Gentil has determined this by the discovery of a great number of graptolites in the eastern region near the Tizi n Imuras. In the red sandstones of the eastern Atlas are important intrusions of volcanic rock on both sides of the central crest. On the southern flank of the mountains in the west the schistose rocks are very steeply inclined to the low plain of the Sus, and are cut by deep ravines sparsely wooded with evergreen oaks and junipers, whose torrents feed that river. Near the foot of the Atlas the plain is strewn with boulders, leaving only small patches fit for cultivation, which form the sites of tiny villages, but the central valley—the plain of Huara—is a wide, flat, alluvial tract, well cultivated, with its important agricultural and commercial centre, Tarudant. There is no snow on the southern slopes of the Atlas below 10,000 feet, while on the north side the snow-line lies at about 5000 feet.

East of the Jebel Sirwa the Atlas mountains are flanked by a rugged plateau of a much higher elevation, being only about 1600 feet below the level of the passes, an absolutely barren region with scarcely any habitation. It is formed mainly of Carboniferous rocks, of which limestone is the most widely distributed formation. The lower central portion of this plateau, however, Mr. Gentil found to be Cretaceous, a system not hitherto thought to occur south of the eastern Atlas. The Sirwa *massif* itself is a transverse volcanic chain connecting the high Atlas and the Anti-Atlas, and has only once been crossed before, by Rohlfs in 1862. It rises from a base of gneiss and other crystalline rocks (mica-schists, etc.), with a steep slope to the west and a gradual ascent on the east. The latter flank is composed of great lava-flows, through which the rivers have cut their channels down to the granitic rock with beds of trachyte and porphyry, the summits being formed of volcanic ash. In structure and configuration this region, with its domes and flat-topped heights, has a great resemblance to the volcanic country of Auvergne, and it stands on an ancient crystalline platform comparable in miniature to the central plateau of France. The small amount of vegetation, which consists chiefly of evergreen oaks, is confined to

the river-valleys. In his present volume Mr. Gentil gives simply the narrative account of his various journeys; a discussion of the scientific results is promised at a future date.

N. E. M.

NIGERIA.

'The Lower Niger and its Tribes.' By Major Arthur Glyn Leonard. London: Macmillan. 1906. Size 9 × 5½, pp. xxii., 559. *With Map. Price* 12*s.* 6*d.*

The title of this book is not altogether a happy one. The reader would have expected an account of the physical characters, sociology, and technology of the natives, whereas the book is a study of their religion and philosophy. The subject is a difficult one, and Major Leonard has not made it easier by wrapping up his ideas in a forced and ponderous style, which makes it difficult to grasp the author's meaning, as the reader gets lost in a maze of words and parenthetical sentences. In fact, had the style been simpler, the book might have been greatly reduced in bulk, and made far more valuable.

From the geographical standpoint, the most important section of the book is the first, in which is given a description of the physical features of the country and a classification of the different tribes. A good map shows the distribution of these peoples, of whom the most important are the Efik, Ibo, and Ibibio.

The rest of the book deals with the beliefs of the native, and will be of interest chiefly to the student of religions, although chapters on possession and human sacrifice may find a wider circle of readers. The scope of this part of the book may best be gathered by the headings of some of the sections—Religion, Spirit Land and Spiritualism, Emblemism, Demonology, etc. Climatic and geographical conditions have had a marked effect on these beliefs, and, as Dr. Haddon says in the preface which he has written, to the dramatic change between the wet and dry seasons "the author traces one of the manifold sources of the inherent dualism of native character and social life."

AMERICA.

THE CRUISE OF THE NEPTUNE.

'The Cruise of the Neptune.' Report on the Dominion Government Expedition to Hudson Bay and the Arctic Islands on board the D.G.S. *Neptune*, 1903-1904, by A. P. Low, B.SC., F.R.G.S., Officer in Charge. Ottawa: Government Printing Bureau. 1906. Pp. xvii.-355, 9 × 6 inches. *With Illustrations and a Map.*

A short account of the voyage and geographical results of the Canadian expedition in the *Neptune* to the Arctic islands has already appeared in the *Journal* (vol. 28 1906, p. 277). The present volume is the official report, and it deals at considerable length with the incidents of the voyage and the scientific results of the expedition. In addition to chapters dealing with geography and navigation, the latter of especial value, and appendices on the zoological and botanical specimens collected, there are reports on the Eskimo and on the geology of the region. Mr. Low's researches on the Central Eskimo, that is the tribes living on the north coast of Labrador, on Baffin Land, and on the shores of Hudson bay, add little to what was already known through the work of Dr. Franz Boas, but Mr. Low's report, being later, serves as a useful supplement to that of Dr. Boas. It is to be regretted, however, that Mr. Low did not adopt Dr. Boas' spelling and nomenclature, as by doing so apparent discrepancies might have been obviated, for it is not always clear whether Mr. Low's tribes are the same as Dr. Boas reported on under other names. Had Mr. Low, in his list of tribes, which is based on that of Dr. Boas, given the names, as recorded by the latter, in brackets, a certain amount of confusion would

have been avoided. Still, this does not greatly impair the value of his work, and it must be remembered that Mr. Low is, first of all, a geologist, and his geological chapters are most valuable. The book is admirably illustrated, and has this advantage over the usual run of Government reports—that it is very readable.

AUSTRALASIA AND PACIFIC ISLANDS.

Australian Tribes.

'The Native Races of the British Empire. Natives of Australia.' By Northcote W. Thomas, M.A. London: Constable. 1906. Size 9 × 5½, pp. xii., 256. *With* 32 *Plates and a Map. Price* 6*s. net.*

The idea of issuing a series of books dealing with the native races of the British Empire is an excellent one, and if the subsequent volumes are as good as this on the natives of Australia, the success of the series is assured. Such books are exactly what are wanted, as they will enable the general reader, who is interested in the peoples of the empire, to discover the facts about any particular tribe without having to consult a large number of highly technical works, while at the same time they should serve as an incentive to further study.

Mr. Thomas, who is an acknowledged expert on things Australian, has in this volume given a lucid and straightforward account of the various tribes living in the island continent. The book is devoid of technicalities, and, except in general chapters on Social Organization and Marriage, Mr. Thomas has actually steered clear of the subtle bypaths of Totemism, to the great advantage of his readers. The author devotes chapters to the manners and customs, occupations and pursuits of the natives, and in an introductory chapter collects together much useful information on the origin of the people and on the geography and physical features of the country. There is a good map, showing the distribution of the various tribes, while numerous illustrations serve to embellish what must be pronounced to be a valuable introduction to the study of the ethnology of the different tribes inhabiting Australia.

POLAR REGIONS.

The "Français" Antarctic Expedition.

'Journal de l'Expédition antarctique française 1903–1905.' Le *Français* au Pôle Sud. Par J. B. Charcot, chef de l'expédition. Préface par l'Amiral Fournier. Ouvrage contenant trois cents illustrations et une carte hors texte. Suivi d'un exposé de quelques-uns des travaux scientifiques par les membres de l'état-major, MM. Matha, Rey, Pléneau, Turquet, Gourdon, Charcot. Paris: Ernest Flammarion. 1906.

Dr. Charcot described his expedition in Antarctic seas so recently to the Royal Geographical Society (vol. **26**, p. 497) that it is unnecessary to recapitulate the voyage of the *Français* in noticing this book. The public is no longer a stranger to the usual routine of modern Antarctic exploration, and it is a little difficult to present the record of a new expedition with striking novelty, for the essential incidents repeat themselves for every explorer, the scenery of rock and ice varies little wherever the Antarctic area is invaded, the meagre *fauna* of penguins, sea-birds, and seals is alike whenever it is found, and the perpetual struggle with ice and storm and fog, though full of surprises and teeming with fresh situations to the navigator in the thick of it, is not without a certain sameness when it comes to be written down. Although all this is true, we welcome Dr. Charcot's book, not only as a well-told narrative of an important expedition but also as a notable contribution to Antarctic literature. It is well written, the style being easy without frivolity, and the narrative, though

brightened by many pleasant touches, remains perfectly serious. It is well illustrated; the photographs are carefully selected and excellently reproduced.

A useful part of the book is a detailed discussion of the voyage of the German whaler *Dallmann* in 1873–74, in which Dr. Charcot brings forward evidence to show that the Bismarck strait of that navigator was the southern end of Gerlache strait, and not an opening leading to the Weddell sea.

A series of appendices deals concisely with the scientific work of the expedition. Under geography an account is given of the running survey made of the western side of Palmer archipelago and of the Biscoe islands, the position of which had been by no means exactly determined by their discoverer. Attention is called to the existence of a zone of calms between the westerly winds about Cape Horn and the easterly winds prevailing on the Antarctic side. Magnetic and gravity observations were successfully carried on; the conditions of the ice and geology were not neglected; and various branches of biology were fairly exhaustively studied on the spot and from specimens brought home. The result shows that much good work was done. It is gratifying to know that the *Français*, after being repaired at Buenos Aires, was purchased by the Argentine Government, and under the name *El Austral* is now employed in keeping up communication with the meteorological observatories on various Antarctic islands which were established after the expedition of the *Scotia*.

H. R. M.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Speleology.

'Höhlenkunde, mit Berücksichtigung der Karstphänomene.' By Walther von Knebel, DR.PHIL. Braunschweig: Friedrich Vieweg und Sohn. 1906. Pp. xvi. + 222. 42 *Figs.*, 4 *Plates*. *Price* 5.50*m*.

The author of this work starts with the statement, in his preface, that this is the first truly scientific handbook for the study of caves which has ever appeared. All previous works, according to him, were concerned too much with the description of the form and size of caves, their beauties, and the size of their stalactites, to which were usually added a few speculations on the age and origin of caves. Science, however, has but little concern with the matters to which other treatises on speleology have given the greatest attention and, therefore, he has written a really scientific text-book, in which not so much the facts as their origin and causes are dealt with. Working on these principles, he has produced a work of a type not unknown in this country, in which everything is accounted for in no uncertain manner, for which publishers seem to find a demand, which may help to spread an interest in science, but certainly does nothing to forward the spread of a true scientific spirit. As an example, we may take the treatment of those peculiar swallow-holes, of which the best-known examples are the sea-mills at Argostoli, where the sea-water flows continuously and in volume sufficient to drive two water-mills; various explanations of this strange phenomenon have been proposed, all of which are passed in review and rejected, except one, which is unhesitatingly accepted. This one is a possible explanation, though not proved, and, to our mind, less probable than that of Fouqué, which is summarily rejected; this, however, is merely a matter of opinion, but as none of the suggested explanations has been satisfactorily established, the author's attitude is less scientific than that of M. E. A. Martel, who is gravely rebuked for describing the phenomenon as unexplained. Apart from this fault of over-certain settlement of doubtful problems, the book covers the subject it professes to deal with in a satisfactory manner; in one respect it is more than up to date, as the references to E. A. Martel, the founder of the Société

de Spéléologie, who has written and done so much to advance both the sport of cave-exploration and the study of the caves themselves, consistently refer to him as the late. M. Martel is, fortunately, still alive, and English readers conversant with French will find his larger work, 'Les Abîmes,' or his little book, 'La Spéléologie,' more useful than the book under review, and quite as scientific.

The Ice Age.

'Die Eiszeit.' By Prof. F. E. Geinitz. Braunschweig: 1906. Pp. xiv. + 198. 25 *Figs.*, 3 *Plates. Price* 7*m.*

Prof. Geinitz has produced a book of a very different type to the general run of glacialist literature. There is only the slightest reference to the work of ice or the cause of the glacial period; the former extension of glaciers is accepted as a fact, and the work is devoted to a summary of the conclusions which have been formed in all parts of the world by the leading workers at this branch of knowledge, a description of the extent of the Post-Tertiary advances and retreats of glaciers, and of their influence on the scenery of the districts over which they spread. The work may best be described as a careful, concise, and practically complete account of the geographical results of glacial geology.

GENERAL.

Life of Mrs. Bishop.

'The Life of Isabella Bird (Mrs. Bishop).' By Anna M. Stoddart. London: John Murray. 1906. Pp. xii., 416. *Illustrations. Two Maps. Price* 18*s. net.*

It is fitting that the life of Mrs. Bishop should have been published by the house of Murray, with which she was connected, both as writer and as friend, for close on half a century; and fitting, too, that the task of writing the life should have been entrusted to Miss Stoddart. It was Mrs. Bishop's own wish, expressed a few years before her death, that should there ever come a call for her biography, Miss Stoddart should be the one to undertake the work. The charge has been well and faithfully executed. Miss Stoddart does not weary her readers with long dissertations on the character of her subject, but by the simple recitation of the events of a life singularly full of interest, allows Mrs. Bishop's striking personality gradually to reveal itself.

In some respects Mrs. Bishop was the most remarkable, as it will scarcely be disputed that she was the foremost, lady traveller of the latter half of the nineteenth century. The detailed story of her life emphasizes the impression already made on those who knew anything about her personally, that her journeys represent in a marked degree the triumph of the human will over the effects of disease and bodily weakness. From childhood she was extremely delicate, and throughout her life frequently suffered from prostrating attacks of a spinal complaint. As a leading physician wrote after her death, she was to most people, "if not a mass of physical contradictions, yet very much of a paradox." His explanation is that "Mrs. Bishop was indeed one of those subjects who are dependent to the last degree upon their environment to bring out their possibilities. It is not a question of dual personality, it is the varied response of a single personality under varied conditions." There must, of course, have been a great reserve of endurance, and the existence of this reserve Miss Stoddart attributes to Mrs. Bishop's "splendid digestion." In spite of the serious ailments which exhausted her constitution, her appetite and her power to assimilate large quantities of food healthily never failed until her last illness. She could go for days with little more than a bowlful of rice and a handful of dates or raisins, but when substantial food was to be had she availed herself of it amply.

Her persistent love of travelling is shown by the fact that not the least arduous

of her journeys were undertaken after she had turned her sixtieth year (she was born on October 15, 1831), and after the doctors had pronounced her to be suffering, not only from inefficient action of the heart, but from an affection of the base of one lung. Even so late as the summer of 1903, when she was already in the grips of the illness which finally terminated her life within a few days of her seventy-third birthday, she was busy planning for another journey to China by way of the Trans-Siberian railway. Her interest in missionary work, particularly medical missions, together with the loneliness which characterized her life in spite of numerous friends after the death of her sister in 1880, and of her husband in 1886, after only a very few years of wedded life, no doubt contributed to send her abroad on her later journeys. But Mrs. Bishop was ever possessed with the wanderer's spirit and the desire to get to "the other side of beyond." Even in the heart of China, far up the Yangtse valley, she was consumed with the longing "to break away from the narrow highways, the crowds, and the oppressive curiosity" of China Proper. All with whom she came into contact on her journeys bear testimony to her absolute unconsciousness of fear. Yet she had no lack of imagination, and her keen powers of minute and sympathetic observation added greatly to the geographical value of her work, notwithstanding the absence of any claim on her part to be a "geographer." Only a few months ago, Miss Stoddart relates, "on board a steamer between Japan and Korea, an Englishman asked a Japanese fellow-passenger what modern book would give him the best idea of Japan. 'Bird's *Japan* is the most valuable,' was the answer; 'it describes the interior better than any more recently written.'" It is interesting to note that Mrs. Bishop herself attributed her exceptional powers of observation to her father's "conversational questioning upon everything" while she was still quite a small child. In early childhood, too, she learned to ride, the doctors ordering her to be out in the open air as much as possible, and since "her father knew every wayside and meadow flower, she learned their names, habits, and uses, and felt for them a passionate love" which made her in later years an enthusiastic student of botany, and enabled her to give wonderful detail to the descriptive passages of her books.

A number of portraits and reproductions from some of Mrs. Bishop's own photographs in foreign lands lend additional interest to this account of her life. The two maps which supplement the narrative are hardly worthy of the rest of the volume. The first, comprising the United States and a large part of Canada, seems to us superfluous as a companion to Miss Stoddart's biography; while the second, showing most of Asia, neither has Mrs. Bishop's routes marked on it nor appears to have been prepared in connection with the text, not even such places as Chemulpho, Ichang, Wan-Hsien, and Paoning-fu—to pick a few names out of the book almost at random—being marked on it.

SHORT NOTICES.

Europe.—'From Carpathian to Pindus. Pictures of Roumanian Country Life.' By Tereza Stratilesco. (London: Fisher Unwin. 1906. Pp. xii. and 379. 2 *Maps and Illustrations.*) The subtitle indicates the scope of this work. The affection of the Roumanian writer for her subject is obvious; the book is full of detail and interest, and the photographs are excellent. The geographical description of the country is slight, but the introduction affords a study in the historical geography of Transylvania. A very full use is made of quotations from native songs and poetry, descriptive and narrative.

'Upper Nidderdale, with the Forest of Knaresborough,' by H. Speight (London: Elliott Stock. 1905. Pp. 367 and lxxii. *Map and Illustrations*), is an excellent type of the historico-descriptive works which exist for practically every such district

in England; it is from the pen of a recognized authority on Yorkshire, and bears evidence of deeper research—in the historical direction—than many books of its class. Description of the land is confined mainly to the scenic standpoint.

'A Scientific Geography: Book II. The British Isles,' by Ellis W. Heaton (London: Ralph, Holland. 1906. Pp. 137. *Maps and Diagrams*), is avowedly a "cram" book. As such it may serve its purpose, but can hardly hope to be inspiring in itself, and its utility might have been extended by short bibliographies accompanying the sections. The treatment of railways will bear careful revision.

Asia.—'Arab and Druze at Home.' By William Ewing. (London: T. & E. Jack. 1907. Pp. xii. and 180. *Map and Illustrations.*) This is a simple "record of travel and intercourse with the peoples east of the Jordan." It is not a scientific work, but the scanty knowledge we possess of the land and races of which it treats justifies its existence. The photographs are particularly good, some giving an excellent idea of land-forms and scenery in the Jordan valley.

'Handbook for Palestine and Syria,' new edition (London: Thos. Cook & Son. 1907. Pp. viii. and 424. *Maps*), is a revision of a well-known guide, with good maps by Messrs. W. & A. K. Johnston. It contains explicit information as to the remarkable extension of travelling facilities made by Messrs. Cook in this region.

'The Tourist's India,' by E. Reynolds-Ball (London: Swan, Sonnenschein. 1907. Pp. xii. and 355. *Map and Illustrations*), may be defined as an introduction to the subject of India for the use of visitors. Many centres of interest are described and pictured; superficial indications of some of the political and administrative problems of the empire are given; appendices contain directions as to methods of travel, observations as to health, and the like.

'The Industrial Organization of an Indian Province.' By Theodore Morison. (London: John Murray. 1906. Pp. vii. and 327.) This book would be of service either in the foundation or in the completion of a study of the economic geography of India. It is not in itself geographical, but it deals with the conditions of labour (chiefly agricultural) and accompanying problems.

'The Romance of an Eastern Capital.' By F. B. Bradley-Birt. (London: Smith, Elder. 1906. Pp. x. and 349. *Map and Illustrations.*) The capital in question is Dacca. Much of its history, as told by Mr. Bradley-Birt, undoubtedly deserved the epithet romantic, and the effect is sustained in the lengthy word-pictures of the Dacca of to day.

'Eine Reise durch Vorderasien im Jahre 1904,' by Erich Zugmayer (Berlin: Reimer. 1905. Pp. xii. and 411. *Maps and Illustrations*), deals with an extended journey in Transcaucasia, northern Persia and Khiva, Bokhara, and western Turkestan. The journey did not, of course, break new ground, and the book is mainly narrative. Its most notable feature consists in some remarkable reproductions of paintings from photographs, one of which ("Grabdenkmal bei Khoi") is a real triumph of colour-work. There are, besides, many ordinary half-tones.

'Under the Sun.' By Perceval Landon. (London: Hurst & Blackett. 1906. Pp. xii. and 288. *Illustrations.*) A series of "impressions" by a practised descriptive writer such as Mr. Landon will interest all who take pleasure in this form of writing. The book ranges widely—from Bombay to Mandalay, from the Khyber to Palk strait. Some photogravures raise the illustration-scheme somewhat above the ordinary standard. The book is also made the medium of presenting, for the first time, a brief record of the "later days of Nana Sahib."

'From West to East,' by Sir Hubert Jerningham, K.C.M.G. (London: John Murray. 1907. Pp. xiii. and 351. *Maps and Illustrations*), consists principally of "Notes by the Way" made during a journey which extended round the world. But the book deals chiefly with Japan; its interests are in the main political, and in

some degree military, for the names of Port Arthur and Mukden head successive chapters. In this connection the two maps of military operations round Port Arthur by Messrs. Johnston are particularly clear and graphic of their kind.

'A Cruise through Eastern Seas,' by A. O. Plate, for the Norddeutscher Lloyd Co. (London: Stanford. 1906. Pp. 293. *Maps and Illustrations*), is conceived in a more literary style than the ordinary guide-book. Dealing with places of leading interest to tourists in a round tour embracing Ceylon, Further India, the Malay peninsula and archipelago, the Chinese littoral, Japan, etc., it briefly furnishes information of almost encyclopædic character about each, and should serve its special purpose excellently.

THE MONTHLY RECORD.

EUROPE.

Charles the Great's Passage of the Alps.—In the *English Historical Review* for July last there is an interesting article on the route taken by Charles the Great through the Alps on his march into Lombardy in 773. Hitherto the generally accepted view, based on the authority of the German chronicles, has been that Charles crossed by the Mont Cenis pass. Mr. Coolidge, the author of the article, is able to show, however, that this opinion is probably erroneous, and that Charles really crossed by the Mont Genèvre route. His view is based on the fact that the German chroniclers obviously presumed that Charles followed the route taken by his father, Pippin, some years before, while the only two chronicles which show any knowledge of local topography, those of Novalesa and of Ado of Vienne, distinctly state that Charles went by way of the Mont Genèvre. The question is not one of great importance, but, as the author says, it "offers a certain interest to those students who delight in clearing up small historical puzzles."

Some Features of the Karst.—The latest student to take up the question of the Karst landscape is Dr. I. V. Daneš, who has devoted some time to a thorough examination of the morphological features of the region of the Lower Narenta. He has described the results of his investigations in a detailed report published (in Czech) by the Bohemian Geographical Society, but has made his conclusions more generally available in a German abstract in the *Abrégé du Bulletin de la Soc. Hongroise de géogr.* (1906, No. 8). The first section of the paper is devoted to the "poljes" of the Karst, and Dr. Daneš begins by sketching the views which have been held by recent investigators as to their mode of origin. It may be remembered that Dr. Cvijić attached much importance to the removal of material by chemical agencies, chiefly, as he supposed, along the lines of previously existing dislocations. He also considered that the major axis of the poljes coincided in direction with the strike of the rocks. Dr. Alfred Grund, in his 'Karsthydrographie' published in 1903, contested the views of Cvijić, holding that the lines of fracture had no connection with the mountain structure, but were merely marginal to the areas of subsidence of the poljes. While not denying that some poljes were formed by the removal of waste material, he considered this to take the ordinary form due to mechanical erosion, the poljes in this case being in part at least drained by open-air channels, and thus not belonging to the category of Karst-poljes in the stricter sense. Grund also attached importance to the gradual sinking of the level of the ground-water, as a condition for the origination of the typical Karst landscape. Dr. Daneš, who has investigated several typical Karst-poljes, has come to conclusions differing from those of either of the above writers. He found that the Imotsko

polje, the largest of those examined, is not primarily the result of dislocation and subsidence, but rather of the removal of easily eroded Eocene strata, though tectonic processes and chemical solution may have had their effect later. The Eocene strata have been subject to strong erosion throughout the region, and the writer is inclined to attribute the formation of many other poljes to a similar cause. The second part of the paper discusses the general hydrographical system of the Karst, in regard to which again conflicting opinions have been held, some believing in the existence of regular underground rivers, while others, like Grund, have imagined that there is merely a general percolation of ground-water. Dr. Daneš believes that both forms exist, and that a cycle of development may perhaps be traceable, the underground rivers marking a more mature stage than the percolating ground-water. Their development will, of course, be favoured by the passage of ordinary streams from an area of impermeable to one of permeable strata.

ASIA.

Further News of Dr. Sven Hedin reached this country during March. It seems that before meeting with the first Tibetans at the Bogchang Tsanpo the expedition suffered great privations, not having seen the sign of a human being for 83 days, while of a total of 122 baggage animals only 9 were left when the caravan reached Ngangtse-tso (as the Ngangon-tso seems to be called in the later accounts). The traveller was very favourably received by the Tibetan officials. He reached Shigatse before February 22, having crossed the belt of very elevated plateau, hitherto untraversed, which intervenes between the Ngangtse-tso and the upper Brahmaputra. The watershed is here further north than has been supposed, some big rivers flowing south to the Tsanpo. The country consists of a complicated labyrinth of ranges and ramifications of rivers. From Stanagbo to the neighbourhood of Shigatse Dr. Hedin travelled by boat, and there was a constant stream of boats with pilgrims on their way to attend the New Year festivals at Teshi Lumbo. Here the explorer met with a hearty welcome from the Teshi lama, who made a great impression on him. From Shigatse he was about to set out on a further journey of exploration towards the north-west.

The Pang-gong Lake.—A striking description of the physical phenomena of the Pang-gong lake and its surroundings is given in the *Journal of Geology* (vol. 14, No. 7, 1906) by Prof. Ellsworth Huntington, who spent a short time (May 1 to May 6, 1905) near the lake when setting out with Mr. Barrett on his latest journey to Central Asia. The writer witnessed the break-up of the ice, with which the lake was covered on his first arrival. As the result of a violent wind from the north-west during the night of May 2, the ice entirely disappeared from the centre of the lake for a distance of 8 or 10 miles, part being piled up on the shore in a ridge 8 to 10 feet high. Prof. Huntington watched a sheet of ice in the act of coming ashore, which it did with a steady motion at the rate of 3 feet per minute, pushing up the sandy beach into a ridge. By testing the degree of saltness in the water after, as compared with before, the disappearance of the ice, he came to the conclusion that a large part of the ice had been melted by the salter warmer water which had displaced the surface film of fresh cold water. Prof. Huntington's remarks on the mode of origin of the lake are of special interest, as he believes it to occupy a rock-basin hollowed out by glacial action. As is well known, the lake extends to a great length, occupying, with others of the same series, a valley among the mountains which must have once drained towards the Indus. Early observers, such as Drew (in 'The Jummoo and Kashmir Territories'), had ascribed its formation to the damming of the original drainage by fans from tributary torrents. Prof. Huntington holds that the streams which formed these fans were quite

incapable of obstructing the main stream of the valley, which must have had a considerable volume, and that the fans owed the possibility of their formation to the previous holding up of the drainage. He shows that between the lake and the present divide the valley floor consists almost entirely of solid rock, and that only the (extremely improbable) existence of a gorge, masked by a narrow belt of gravel and lacustrine deposits, could vitiate the conclusion that the basin is terminated by a rock-lip, rising well above the lake-level. The glacial origin is, he says, supported by the abundant evidences of glacial action in the vicinity. The paper treats in some detail of the fluctuations of the lake-level in subsequent periods, as evidenced by lacustrine deposits and shore-lines, which, with numerous old moraines, indicate two extremes of moisture, or at least of lake and glacier expansion, intervening between extremes of aridity or of lake and glacier contraction. The process of desiccation seems to have been oscillatory, and as such oscillations seem to have affected vast areas, they demand the closest study.

Obrucheff's latest Expedition to Central Asia.—In the summer of 1906 this traveller returned to the region of the Tarbagatai, to complete the researches begun during the previous year (*Journal*, vol. 28, p. 180). A short account of the results appears in the first number of *Petermanns Mitteilungen* for 1907. The region examined lay on the borders of Chinese Dzungaria, and its physical geography and geology had been previously almost unknown. It includes the ranges known as Kojur, Urkashar, Semistai, and Jair, with the adjacent valleys. The former all consist of "horsts," with more or less even surfaces covered with alpine meadows, and of the peneplain type. On certain sides they fall very steeply, and their borders are broken by impassable ravines. The horsts themselves are all composed of Devonian and Carboniferous formations, chiefly clay, quartz, and siliceous slates, but including some sandstones and limestones. On their margins there are intrusive masses of porphyry, melaphyr, etc., while the foothills consist of sandstones, conglomerates, etc., of Mesozoic age. Some traces of former glaciation were seen, and many observations of subaërial denudation, the formation of loess, and the like, were made.

AFRICA.

Scientific Research in German East Africa.—During 1906 two expeditions were sent out to East Africa under the auspices of the "Commission for the geographical investigation of the German Protectorates." The one, under Dr. Fritz Jaeger, was commissioned to carry out geographical researches in the northern part of the territory; the other, under Dr. Karl Weule, had for its main object ethnographical studies in the more southern portion. Information regarding the work accomplished by both expeditions is given in the *Mitteilungen aus den Deutschen Schutzgebieten*, vol. 19, pt. iv. One section of Dr. Jaeger's journey was referred to in the February number (p. 226, *ante*). After returning from his visit to the Kiniarok steppe, the traveller, with his companion Herr Oehler, of Frankfurt, an experienced alpinist, set out from Moshi for the Kibo peak of Kilimanjaro on August 10, 1906, with the intention of investigating the western glaciers. This was done from a base-camp at a height of a little over 14,000 feet, special attention being devoted to the Penck glacier. Following on a period of copious rainfall, the snow was found to reach down to 15,750 feet, and Dr. Jaeger was able to study the early stages in the production of "nieves penitentes" during the process of melting (cf. *Journal*, vol. 25, p. 213; vol. 26, p. 91). He found that the primary ridges on the *firn* surface ran in one constant direction, viz. west-north-west, with no relation to the direction of slope, though this latter determined the breaking up of the ridges into individual "penitentes," apparently under the action of water. While

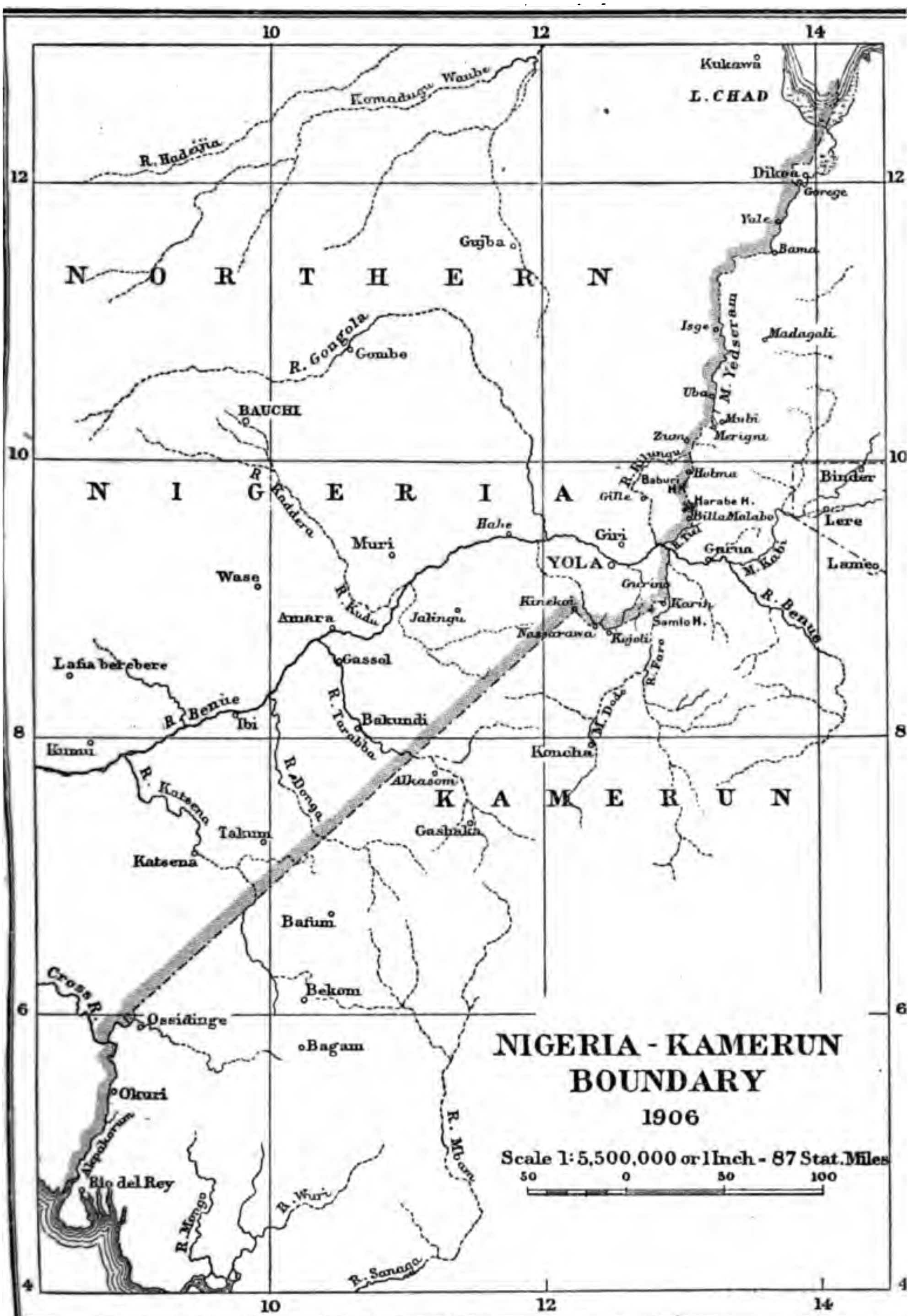
agreeing that the formation of the ridges is due to solar radiation, he is unable to suggest any better explanation than the more or less unsatisfactory ones already put forward. The effects of ice-avalanches on the surface of the snow were also noticed. With a view to future measurement of the rate of flow of the Penck glacier, the travellers marked with red paint a series of rocks stretching across it between points marked on either side. They subsequently made their way to Lake Victoria by way of Umbugwe and Iraku, climbing the Gurui volcano *en route*. They were about to extend their work over the region of inland drainage to the north-east. Owing to disturbances in the Kondoa-Irangi region, Dr. Weule thought it best to change his plans, and carried out some important investigations among the tribes of the extreme south of German territory, north of the Rovuma. He returned to the coast in November last.

The Nigeria-Kamerun Boundary.—The accompanying sketch-map shows the course of the boundary between Nigeria and the Kamerun, as finally fixed by the agreement of 1906 (see *Journal*, vol. **28**, p. 509). That agreement had to do with the northern section of the line, from the neighbourhood of Yola to Lake Chad, no important change having been made in the southern half since it was fixed by the agreement of November 14, 1893.

Proposed Railway from Beira to the Zambezi.—A scheme has been set on foot for a railway to connect the port of Beira with the Zambezi at some point above the portion of the lower river which is so obstructed by shifting sandbanks that navigation is a matter of difficulty. We learn from *South Africa* of February 16 last that a survey of the proposed route is now being made by Belgian engineers. The length of the line would be about 250 kilometres (150 miles), and the terminus suggested is at Lacerdonia, near the confluence of the Shire with the Zambezi, the permanence of the river-bank at this spot being a point in its favour.

Recent Exploration of the Kamolondo.—The Kamolondo, the 400-mile section of the western main branch of the upper Congo from the Kondé rapids (9° 10′ S.) to about Hell Gate (5° 20′ S.), was first traced in 1896 by Captain Brasseur. A second and more technical survey was made by Lieut. Lattes, between April and August, 1903. A third survey, just concluded by Lieut. Mauritz, is reported in the *Mouvement Géographique* (1907, No. 7). In accord with Lattes, he finds that the 250 miles of the Kamolondo from Lake Kissale to Hell Gate, with mean breadth of 1600 feet, flows with a deep and regular current between well-marked banks, offering an easily navigable channel. From Lake Kissale, on the other hand, to the Kondé rapids, a stretch of 150 miles, the river winds through a broad low plain, which it inundates by its annual rise. In this region a series of permanent lakes (relics of the former Kamolondo lake), with ill-defined shores, and varying with the river's level, border the principal channel. Here the channel calls for some engineering in order to its utilization. Another Lake No, the Kissale grows papyrus and other aquatic plants obstructive to thoroughfare. These will have to be lastingly cleared out. Here, therefore, will have to be undertaken a work similar to that accomplished in effecting a passage through the sudd of the Nile. On the conclusion of that undertaking, the Kamolondo will be opened to steam navigation across the lake.

The Comoro Islands.—The *Zeitschrift* of the Berlin Geographical Society (No. 9, 1906) contains an interesting general account of the Comoro islands by A. Voeltzkow. All the islands are volcanic, rising steeply from the sea. In the last century there was volcanic activity on Great Comoro, and but a few years ago destructive eruptions occurred. Great Comoro was till recently little known in a scientific sense. In 1863 Dr. Kersten made the first ascent of its high volcano. In 1884


NIGERIA - KAMERUN
BOUNDARY
1906
Scale 1:5,500,000 or 1 Inch - 87 Stat. Miles
N O R T H E R N
N I G E R I A
K A M E R U N
L. CHAD
Kukawa
Dikoa
Gorege
Yola
Bama
Gujba
R. Hadejia
Komadugu Waube
R. Gongola
Gombe
BAUCHI
M. Yedseram
Isge
Madagali
Uba
Mubi
Merigni
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Holma
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Malabo
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Lere
Lameo
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Giri
YOLA
Muri
Wase
Garua
M. Kebi
R. Benue
Kinekoi
Nassarawa
Kojoli
Jalingu
Amara
R. Kudu
Gassol
Lafia beribere
R. Benue
Ibi
R. Taraba
Bakundi
Kunui
R. Katsena
R. Donga
Alkasom
Koncha
M. Dodo
R. Faro
Takum
Gashaka
Katsena
Bafum
Bekom
Cross R.
Ossidinge
Bagam
Okuri
Akpakorum
Rio del Rey
R. Mongo
R. Wuri
R. Mbam
R. Sanaga
10
12
14
8
6
4

M. Humblot, collector and scientific explorer in Madagascar, was charged by the French Government to make an examination of the island. His mission led to the formation of the "Société de la Grande Comore" for the economic exploration of the island. There was still, however, an ample field for Herr Voeltzkow's scientific exploration. Great Comoro is the largest and highest of the four islands. Whereas Anjuan rises to 5000 feet and Moheli to 2000, Great Comoro reaches 8000 feet. It is 38 miles long by 11 miles in average breadth, and contains two elevated regions. In the south is the mountain mass of Karthala, filling up nearly the whole centre, and with a still active volcano, rising uniformly like a huge dome out of the sea, with flat summit, to 8000 feet. In clear weather the volcano is visible over 100 miles. In the north the ground rises gradually from the coast to an irregular plateau of over 2000 feet, above which numerous bare, regularly shaped cones, with truncated craters, rise to about 4000 feet. These two elevations, north and south, are separated by a depression with an average height of about 1600 feet, forming an enormous desert field of younger lava-streams, intersected by paths communicating between the east and west. The coast region of the Karthala *massif* up to 2000 feet is the cultivated zone, occupied by coconut palms, banana groves, mangoes, plantations of vanilla, cacao, coffee, etc. Above, up to 6000 feet, is the great moist primitive forest. The summit is covered with high grass and low bush, presenting steppe-like meadows. The climate is tempered by the insular situation and the prevailing winds. The north-east rain-bringing monsoon begins at the end of October, and is often squally. The south-west monsoon is steady, and yields occasional showers; but November to March is the rainy season proper. On the upper slopes of the high volcano there is continuous rain on the weather side. Particularly interesting are Dr. Voeltzkov's remarks on the history of the settlement and the anthropology of the islands.

Migrations in the Ogowe Basin.—The importance of the study of the migrations of primitive peoples cannot be overestimated, and Lieut. Avelot has done great service, particularly to anthropologists, in publishing, in the *Bulletin de Géographie Historique et Descriptive* (vol. **20**, p. 357), a careful account of the movements of the peoples dwelling in the basin of the Ogowe and the adjacent country. From the records of old travellers, from native traditions and from personal observations, M. Avelot has reconstructed the past history of these tribes—the most important of which are the Bakalai, Fiottes, and Pahouins or Fans—and has been able to trace their movements for several generations. The value of the paper is greatly increased by a series of excellent maps, showing the positions of the tribes at different periods, and by two sets of tables—one an attempt at a classification of the peoples in the Ogowe basin, and the other a short comparative vocabulary of thirty-five dialects spoken in the French Congo, and of eleven other African tongues. The paper is one of the most important and useful that has appeared for some time, and it is to be hoped that M. Avelot will be able to carry out similar investigations among other peoples.

Note on Ruwenzori: Erratum.—In the March *Journal*, p. 329, line 1, for "Mount Baker" read "Mount Speke."

AMERICA.

The Malaspina Glacier.—In *Science* of January 4, 1907, Prof. R. S. Tarr calls attention to the remarkable changes which had taken place in some of the glaciers which debouch on the great Malaspina ice-field during the ten months which elapsed between his visits of 1905 and 1906. In the former year the surface of these glaciers offered no greater obstacles to easy travel than they had at

the time of the expeditions of Russell, Bryant, and others to Mount St. Elias, while in the latter they were so crevassed, owing to a rapid forward movement of the ice, as to be almost impassable. A striking contrast, however, was afforded by others of the glaciers, which showed practically no change during the same interval. Similar phenomena were displayed by the glaciers entering Yakutat bay, some of which showed a marked advance, while others had remained stationary. The writer thinks that these facts are not to be accounted for by ordinary climatic variations, but suggests that the severe earthquake shocks which visited this region in 1899, and which caused a sudden uplift of the coast-line in Yakutat bay (see *Journal*, vol. 28, p. 30), or possibly some previous earthquake, may have shaken down unusual quantities of snow and ice from the mountains near the head of some of the glaciers, thus starting a wave of advance. The suggestion is certainly ingenious, though even if earthquake shocks may have been the cause of the advance, the method of action referred to does not seem to be the only one capable of producing the given effect. Might not these have resulted, *e.g.*, from an alteration of the slope of the ground beneath the ice, possibly at the time of the disturbances of 1906? Anyhow, as Prof. Tarr says, it will be a matter of great interest to carefully watch the behaviour of all these glaciers during the next few years.

The New Salton Sea.—The recent formation of a lake of considerable area in the Salton depression, owing to the irruption of water from the Colorado river through irrigation channels, has already been referred to in the *Journal* (vol. 27, p. 631), and was also discussed by Major Beacom in the paper on irrigation lately read before the Society. From a paper by Mr. C. A. Byers in the January number of the *Popular Science Monthly* of New York, it seems that the control of the overflow from the Colorado is a matter of much greater difficulty than has been supposed. Mr. Byers discusses the possibilities of a permanent alteration in the geography of this region, and points out that any advantages which might be supposed to accrue from the existence of an inland sea in the arid tract north of the Gulf of California could hardly outweigh the loss of so large an area of irrigable land. Owing to the damage caused to the Southern Pacific Railroad by the irruption of the Colorado, the work of controlling the river was taken in hand by the company, and the various attempts to secure the mastery, each more determined than its predecessor, are described in the paper referred to. After six failures, a seventh attempt, involving an outlay of $10,000, was commenced early in 1906, and seemed for a time likely to be successful. But a postscript to the paper records the fact that on December 7 last the river once more broke through, the conditions becoming as bad as six months previously, and the possibilities of a permanent Salton sea more pronounced than ever. The recent break occurred just below the new dyke, which had a length of over 10 miles, and has already excavated a cañon-like channel in the easily eroded material of the river-bank. To ensure success, about 20 more miles of dyke would be needed, and this, too, would have to be built without delay. The article is illustrated by photographs of the various channels and controlling works. It may be mentioned that a somewhat abnormal amount of rainfall in the extreme west of the United States has been attributed by popular imagination to the Salton inundation, but it need hardly be said that such ideas can have little scientific basis.

Expeditions to the Pilcomayo.—The German engineer, W. Herrmann, last year undertook an expedition for the examination of the middle course of the Pilcomayo, which, though the goal of many exploring expeditions, has hitherto been imperfectly known. According to a communication from the traveller printed in the *Zeitschrift* of the Berlin Geographical Society (1906, No. 10) this object was successfully accomplished, the course of the river being followed from 22° to 24° S.,

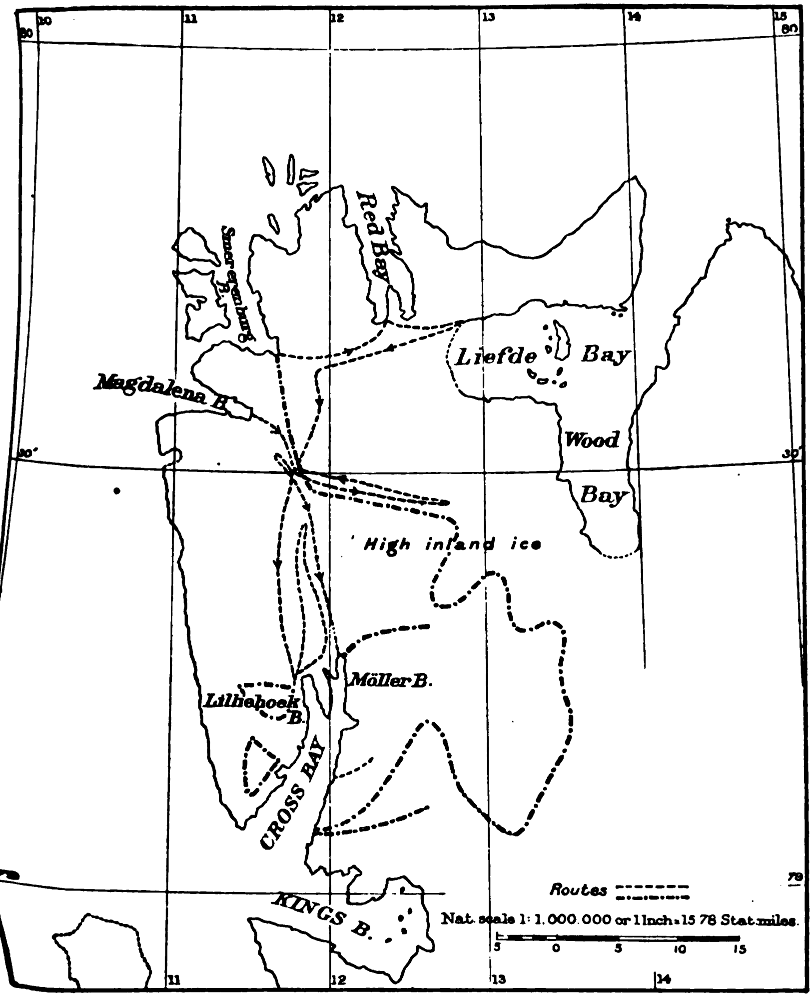
though, on arriving at about the latter parallel, it was found impossible to continue the journey owing to the splitting up of the river into many shallow channels, and the swampy nature of the flat country on either side. The greater part of the descent was accomplished in a "chalana" or covered boat, 20 feet long. The river, between the parallels mentioned, consists of a single channel only, without rapids, and navigable for small vessels. The banks were at first 30 to 40 feet above the water, but became gradually lower, being in places only 3 feet high. The river was exceptionally low at the time. The whole middle and lower course of the Pilcomayo, from 22° S. to its mouth, has also been surveyed within the last two years by a party from the side of the Argentine under Mr. G. Lange, but the German traveller does not seem to have met the latter. An account of Mr. Lange's expedition, with a map of the river in seven sheets, on the scale of 1 : 100,000, has quite lately appeared in Buenos Aires.

The Distribution of Earthquakes in Chile.—The well-known Italian seismologist, Dr. M. Baratta, brings together the historical data bearing on this question in the January number of the *Bolletino* of the Italian Geographical Society, giving, besides, a map showing the general distribution of the earthquakes. While no general conclusions are presented by the writer, the facts adduced show how all the great earthquakes in this much-disturbed region have tended to be concentrated within definite areas, the zones of greatest seismic activity lying at intervals along the coast-line, from the Peruvian frontier in the north to Valdivia in the south. For frequency of destructive earthquakes, the portion of the coast from Caldera and Copiapo in the north to Coquimbo in the south seems to be particularly prominent, while the tract with Valparaiso as centre stands out for the violence of the destructive agencies. As a rule, Valparaiso has lain within the zone of greatest destruction, while Santiago has suffered less, though the case is occasionally reversed. Chile also feels the influence of the unstable zone of Mendoza in the Argentine, but the destructive effects are in this case extremely limited. It may perhaps be questioned how far the spaces between the zones laid down are really less subject to seismic disturbance, and whether their apparent freedom may be due in part to the paucity of centres of population where the destructive effects would be seen.

POLAR REGIONS.

The Prince of Monaco's Expedition to Spitsbergen.—We have received the following communication from Captain G. Isachsen: "I have delayed answering your letter of September 29, 1906, until H.S.H. the Prince of Monaco, who fitted out the expedition, had presented his 'Campagne Scientifique' to the Academy of Science in Paris. I now send you a note stating briefly what ground we have covered. I am now working out a map of the region explored—one-half on the scale of 1 : 100,000, the other half 1 : 50,000. The expedition consisted of seven men under my command. (1) Between July 14 and 19 the preliminary topographical work was carried out at Cross bay. (2) Between July 20 and August 15 the traverse of New Spitsbergen was effected by two parties—the one coming down at the mouth of Cross bay, the other at Müller bay. Afterwards one of the parties traversed another line from Magdalena bay to Lilliehook bay. (3) August 15 to August 30 smaller trips in the interior completed the work. We found the most part of the interior of New Spitsbergen covered with ice; a large ice-plateau south of Liefde bay drains to this bay, but mostly to Kings bay. The height of this plateau was from 800–1000 metres above the sea. The geologist has collected specimens, and will work out a map of the geology of this part of Spitsbergen.

The erosion is very great. The soil is not solid enough to bear vegetation. The temperature of the air varied between 8° and −7° C. The topographical work has



SKETCH OF PART OF SPITSBERGEN, SHOWING ROUTES TRAVERSED BY THE PRINCE OF MONACO'S EXPEDITION.

been done largely by the photogrammetric method, and we have thus a large quantity of excellent photos."

Mr. Mikkelsen's Expedition.—Mr. Mikkelsen has sent us a statement of the position and prospects of his expedition at the end of last September, together with a discussion of the evidence which seems to point to the existence of land not far from the north coast of Alaska. The passage of Point Barrow (*Journal*, vol. 28, p. 403) was only effected through the aid courteously rendered by Captain Cottle of the steam-whaler *Belvedere*, who took the *Duchess of Bedford* in tow. Otherwise it would hardly have been possible for a sailing vessel such as Mr. Mikkelsen's

to pass the point in the teeth of an adverse wind and strong current. Winter quarters were finally selected at Flaxman island, after vain attempts to push further east, and Mr. Mikkelsen thought that this spot would prove an advantageous base for the exploration of the Beaufort sea by sledge-journeys during the spring. From his own observations, and from careful inquiries among the whalers, his belief in the existence of land to the north has been much strengthened. He has convinced himself of the heavy nature of the ice of the Beaufort sea, and of its general nearness to the land. At Point Barrow it does leave the coast in normal years, but further east, towards Cross island, it seems to be almost permanent, though still further in the same direction, off Herschel island, there is nearly always open water quite early in the year. After alluding to the land reported by Captain Keenan, who is said by the whalers to have been a thoroughly reliable man, and to Eskimo legends pointing in the same direction, Mr. Mikkelsen lays stress on the existence, year after year, of a great crack in the ice, which is used by the whales in their annual migration to north-east towards the end of May, between which date and July they are never seen on the coast. Migratory birds also pass annually in the same direction, evidently to some unknown breeding-ground. By a trip over the ice north of the winter quarters during the present spring, and another in 1908 from Cape Prince Alfred on Banks Land, Mr. Mikkelsen hopes to set at rest the question of the existence of land in this locality.

Dr. Charcot's New Expedition.—We have received from Dr. Charcot a brief statement of his plans for a new expedition to the Antarctic for the purpose of continuing his researches in the Graham Land region. At the explorer's request, a committee was lately appointed by the Academy of Sciences to consider the question, and as a result of its favourable report the Academy, on February 4, decided to support his proposals for a second French Antarctic expedition. The following is an outline of the provisional programme. A vessel will be specially built for the purposes of the expedition, possibly at Dr. Charcot's own expense. The explorer and his companions would proceed in the spring to the site of the rich deposits of fossils discovered by the Swedish expedition at Mount Bransfield and Seymour island, and, having either returned to Ushuaia with the collections or left them at an accessible spot in the region to the south, would, from Wandel island as a base, extend the explorations carried out during the first expedition to the unknown region south of Loubet land. The expedition would winter at a suitable spot, making journeys along the coasts and into the interior, with a view both to scientific observations and a general reconnaissance of the region to the south. During the following summer the voyage would be resumed according as circumstances dictated. Scientific work of all kinds would be kept up throughout the course of the expedition. Dr. Charcot calculates the probable expense, including the cost of the ship, at not over £30,000.

GENERAL.

Masudi on Volcanoes.—An article in the *Journal of the Bombay Branch of the Royal Asiatic Society* (vol. **22**, No. 61) brings together the statements respecting volcanoes made by the Arab historian Masudi (tenth century A.D.). As the historian travelled as far as the Malay peninsula and the Chinese seas, his views, embodied in 'Meadows of Gold and Mines of Jewels,' may be taken to be based on personal observation. He speaks of volcanoes in the most distant islands in the Sea of China, which the author of the article takes to be those of Java and Sumatra. In dealing, too, with the volcanic belts of the Caucasus (long extinct) and of Sicily, Masudi refers to the volcanoes in the kingdom of the Maharajah, which may be identified as those of Java and Sumatra, then under a Maharajah, and to the volcano

of "Zabej" (Java ?) in the Sea of China. The volcano of Sicily is called "Jabal al Barkan." He also speaks of the volcano of "Wadi Berhout in Hadramaut," and of that of "Esk (Eskibun) in the country of Fars," and of the hot springs of sulphur and vitriol in the province of Sirwan. So much for Masudi's geographical field. His volcanology is still anthropomorphic. From volcanoes "emanates a frightful voice announcing the death of a king or chief." He also speaks of "the sound of drums, flutes, lutes," etc. A volcano is also a "hill," or seat, of punishment for the wicked.

OBITUARY.

Dr. Alfred Kirchhoff.

Dr. Alfred Kirchhoff, one of the best known and most successful workers in the cause of geographical education in Germany, died on February 8, 1907, at the age of sixty-nine years. Towards the end of 1904 he had been forced, by failing eyesight, to resign the professorship at Halle University, which he had held for thirty-one years, and his powers had since gradually declined, the end being, perhaps, hastened by the results of a fall in the autumn of last year.

Kirchhoff will be remembered, side by side with Ratzel and Richthofen, as one of the band of successful teachers to whom the present satisfactory position of geography in Germany has been mainly due. During his whole career as professor his stimulating influence had been felt by a constant succession of pupils, who have themselves become centres for the propagation of his ideals and methods in many different parts of Germany; and the universal regard and affection which they have constantly testified towards him supply one of the best testimonials to the importance of his work. His competence as a geographer was due in great measure to the many-sided character of his interests, which well qualified him to deal with a subject which forms, like geography, a link between the sciences of nature and man. Born at Erfurt in 1838, he completed his education at the universities of Jena and Bonn, where he paid attention alike to natural science, history, philology, and other subjects. For some years he worked as a teacher in various schools, and the experience so gained no doubt did much to qualify him in later years to deal with the needs of geographical education in all grades. Among his most important services to this cause were the various educational works which came from his pen, especially the 'School Geography,' which first appeared in 1882; while his contributions to a clearer understanding of the scope and possibilities of the subject as an educational instrument were no less valuable. It was to the regional side of geography—the presentation of a complete picture of a given country under all its aspects—that he attached especial importance, as was evidenced by his zealous furthering of regional studies in Germany, which had its outcome in the excellent work of the "Centralkommission für wissenschaftliche Landeskunde von Deutschland For twenty years Kirchhoff edited the well-known collection of monographs, brought out under the auspices of this body, with the title 'Forschungen zur deutschen Landes- und Volkskunde.' He was also responsible, with others, for the periodical reports on the literature of German geography. A work of wider scope was the series of monographs on the geography of Europe, written by various experts under his general editorship, and originally planned, under the title, 'Unser Wissen von der Erde,' to form part of a descriptive geography of the whole world.

Among Kirchhoff's shorter writings were various papers on the geographical and political relations of mankind, which bore witness to great insight and breadth of view. Among these were a study entitled 'Das Meer im Leben der Völker'

(originally delivered as an address to the "Institut für Meereskunde" at Berlin), and another on the ideas 'Nation' and 'Nationality.' A small volume of sketches of this character has lately been translated into English under the title 'Man and Earth' (Routledge's 'New Universal Library,' 1906).

CORRESPONDENCE.

Fall in Level of Central African Lakes: Lake Nyasa.

In the *Journal* for December, 1906, there appeared a letter from Mr. William Piercy on this interesting subject, in which he pointed out the fact that Lake Nyasa has been falling for a period of ten years, and enclosed a photograph of the marks painted on the rocks at Monkey bay, showing the level of the lake in different years since 1897.

The level of Lake Nyasa has been more or less steadily falling for a much longer period than ten years. My own experience of it goes back twenty—to 1887; and for some eight or ten years before that, the lake and upper Shire river was navigated by the Scotch Free Church Mission steamer *Ilala*.

With regard to the twenty-years period of which I have personal knowledge, the level of the lake in 1887 was considerably higher than that registered on the rocks at Monkey bay in 1897. The fall for some years previous to 1887 appears to have been more or less steady. In Livingstone's time a steamer drawing 6 feet of water could travel up the Zambezi and Shire rivers as far as Chiromo, and the level of the Shire river depends entirely upon the level of Lake Nyasa. At the present date the Shire at Chiromo has almost ceased running.

Mr. Piercy speaks of "a period of desiccation." This, I think, is a misleading description of the present climatic conditions in British Central Africa. There is nothing which could be described as "desiccation." The basin of Lake Nyasa (as in the case of all other Rift lakes of Central Africa) is an extremely limited one; consequently, if the rainfall within that limited area happens be in any year a low one, the result is that the lake fails to have its normal rise. The great bulk of water entering Lake Nyasa comes in at the north end. On the east there is no river ot consequence, and on the west the few comparatively large streams, such as the Rukuru, Bua, Loangwa, and Lilongwe, are mostly dry by the month of August, and remain in that condition until December. Rainfall records kept at Zomba, in the southern portion of the British Central Africa Protectorate, distant 60 miles from the south end of Lake Nyasa (outside the Nyasa basin) are as follows, for the past twelve years:—

1895	49·92
1896	63·34
1897	46·36
1898	63·83
1899	60·89
1900	42·87
1901	50·41
1902	48·52
1903	49·35
1904	74·13
1905	57·78
1906	39·46

From this it will be seen that immediately south of the Nyasa basin there

cannot be said to have been any marked falling off in the annual rainfall, which is curious.

There is, I think, little doubt that both in the Tanganyika and Nyasa basins there are lengthy periods of both ample and deficient rainfall. With regard to Tanganyika, we know (*a*) that when Livingstone and Stanley circumnavigated the lake, the Lukuga river had no outlet, and it was clear that the lake had not run out at the Lukuga for many years previously. (*b*) It is also known that at some previous period the lake *had* its outlet at the Lukuga. (*c*) We know that not long after Stanley's visit, the lake again broke out at the Lukuga river. (*d*) Of recent years the level of Tanganyika has fallen again, and if the Lukuga has not already quite closed up it is highly probable that it will do so very soon.

Lake Nyasa has, I feel sure, in the past had similar periods, and I think it reasonable to suppose that the Shire river, the outlet of the lake, has in previous history closed up and re-opened in the same way that the Lukuga has. More than a year ago I stated the opinion that if the present deficient rainfall period continued for a year or two, we should see the Shire close at Fort Johnston, where the lake has its exit. At the present date there are only a few inches of water. Last year, at the termination of the dry season, and before the rains had caused the lake to rise, but when the first local rain arrived, the curious sight was seen of streams running into the upper Shire and flowing north, "up" the course of the river *into* Lake Nyasa, instead of in the usual direction to the south.

Mr. Piercy is apparently of opinion that if the "channel of the upper Shire" were by some means cleared out or dredged, this river would, in spite of the present condition of Nyasa, continue to be a navigable waterway. Unfortunately, as Nyasaland knows to its cost, the reason why this river is practically ceasing to be a waterway is, not that there are any serious obstructions or "siltings up" in its channel (which is some 300 miles in length), but because there is no water coming out of Lake Nyasa to run down that channel. It is obvious that the best of channels is of little use if there is no water to fill it. The condition of the lake now is that it has almost ceased to run over at its exit at the south end. The only possible means of obtaining a larger supply of water from the lake would be if there were some description of abrupt lip at the exit which could be lowered by excavation. Even this, as I need hardly point out, would have to be done year after year so long as the lake continued to fall. As a matter of fact, however, any such lowering is beyond human power. The lake has no abrupt lip. There is practically no fall on the upper Shire river from the point of its exit, down to the settlement of Liwonde (a distance of 60 miles), the difference in level being only a few feet.

In default of a permanent rise in the level of Lake Nyasa, the only means by which the Shire river could be made permanently navigable, would be the erection of a gigantic dam at the south end of the lake, which would hold up all surplus water during the height of the rainy season, with vast sluices through which the water could be passed during the dry season. Such a work would cost many millions sterling, and is clearly out of the question.

Mr. Piercy also speaks of "afforestation," presumably as a means of increasing the rainfall in the Nyasa basin. There has been no deforestation in this region. Patches of native cultivation form a very small percentage of the area, which is covered with the usual East Central African "bush" (somewhat stunted forest growth). European cultivation or forest-clearing in the Nyasa basin is as a pin-prick on the map. I have no hesitation in saying that this has no bearing on the fall in level of Lakes Nyasa and Tanganyika.

ALFRED SHARPE.

British Central Africa, January 27, 1907.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1906–1907.

Eighth Meeting, February 25, 1907.—Colonel G. Earl Church, Vice-President, in the Chair.

Elections.—*Alfred Baker; Charles John Baker; Colonel H. Bower, I.A.; Harold Simon Carvalho; Robert Lorimer Corbell; Major-General H. R. Courtenay, R.A.; James Coyle; Captain H. R. Dunn; Alfred H. Garlick; Kynard Hawdon; Frederick David Charles Shaw Kennedy; Dr. Norman Maclaren; Commander Charles R. Moore, R.N.; Lieut. Charles F. Nuneley; John Parker; James Parsons; Arthur Ingram R. Smith; Konojo Tatsumi.*

The paper read was:—

"Inland Waterways." By George G. Chisholm, M.A.

Research Department.

March 8, 1907.—Major C. F. Close, C.M.G., R.E., in the Chair.

The paper read was:—

"Physical Features of the Morphology of Turkestan." By W. Rickmer Rickmers.

Ninth Meeting, March 11, 1907.—The Right Hon. Sir George T. Goldie, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

Elections.—*Lieut.-Colonel T. H. A. Anderson; Hy. Bryant Bigelow; P. L. Blyth; Charles Calvert Bowring; Richard Hugh Royds Brocklebank; Ernest H. Carey; Elmer L. Corthell; Colonel E. Dickinson, R.E.; Hastings Russell Eastcott; Albert Ezra Neale; Captain Lord Bernard Gordon-Lennox; Captain Lord Esme Charles Gordon-Lennox; Henry Douglas Morpath Haszard; Robert Ernest Hills; Thos. Jowett; Alan Collingwood Knight; Lieut. D. Pudsey; Lieut. I. D'Esterre Roberts, R.A.; F. Stanley Service; Miles Staniforth Cater Smith; I. A. Stigand; Mark Sykes; Le Comte de Valhermey.*

The paper read was:—

"Journeys in Northern Mesopotamia." By Mark Sykes.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendes.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Balkan Peninsula. **Cvijic.**
Sketch of the Geography and Geology of Macedonia and Ancient Servia, with observations on Southern Bulgaria, Thrace, the neighbouring regions of Asia Minor, Thessaly, Epirus, and Northern Albania. By J. Cvijić. 2 vols. [In Servian.] Belgrade, 1906. Size 13 × 9½, pp. viii. and 690. *Maps and Illustrations. Presented by the Author.*

Germany—Minerals. **Bruhns, etc.**
Die nutzbaren Mineralien und Gebirgsarten im Deutschen Reiche. Auf Grundlage des gleichnamigen v. Dechenschen Werkes neu bearbeitet, unter Mitwirkung von H. Bücking, durch W. Bruhns. Berlin: G. Reimer, 1906. Size 9 × 6, pp. xx. and 860. *Map. Price* 16*s*.

A carefully revised edition of the work brought out by Von Dechen in 1873. The geological introduction has been re-written, and the special sections thoroughly revised and rearranged for facility of reference. The work forms a valuable handbook on the mineral resources of Germany.

Germany—Würtemberg. **Gugenhan.**
Der Stuttgarter Talkessel—von alpinem Eis ausgehöhlt! Von M. Gugenhan. Berlin: R. Friedländer & Sohn, [*not dated;* 1906]. Size 10½ × 7, pp. 26. *Maps. Price* 2*s*. 3*d*.

Holland—Fisheries. *Rev. Maritime* 170 (1906): 395-416. ———
La pêche hollandaise dans la mer du Nord et dans le Zuiderzée. (Rapport du vice-consul de France à Rotterdam, 11 Octobre, 1905.)

Hungary—Place-names. *Abrégé B.S. Hongroise G.* 34 (1906): 105-107. **Buday.**
Grundbuch der Ortsnamen Ungarns. Von Dr. L. Buday. (*Földrajzi Kozlemények* 34 (1906): 224-229.)

Hungary—Water-power. *Abrégé B.S. Hongroise G.* 33 (1905): 131-141. **Viczián.**
Ueber die Wasserkräfte Ungarns. Von Eduard Viczian (*Földrajzi Közlemények*, 33 (1905): 387-403. *With Maps and Illustrations.*

Italy—Vesuvius. *Science* 24 (1906): 284-286. **Eastman.**
Disputed Vesuvian Eruptions. By Dr. C. R. Eastman.

The writer sees no reason to doubt the eruption of the early sixteenth century mentioned only by Ambrogio di Leone.

Italy—Vesuvius. *Quarterly J. Geol. S.* 62 (1906): 476-483. **Lorenzo.**
The Eruption of Vesuvius in April, 1906. By Prof. G. de Lorenzo. *With Map and Illustrations.*

Norway—Landslip. *B.S.G. Philadelphia* 4 (1906): 46-50. **Brigham.**
A Norwegian Landslip. By Albert Perry Brigham. *With Map.*

The writer visited the site of the disastrous catastrophe of January 15 1905, six months after it occurred.

Rumania. **Stratilesco.**

From Carpathian to Pindus: pictures of Roumanian country life. By Tereza Stratilesco. London: T. Fisher Unwin, 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. xii. and 380. *Maps and Illustrations. Price 15s. net. Presented by the Publisher.*

See note on p. 453.

Russia—Finland—Fisheries. **Sandman.**

Conseil Exploration Mer, Publ. Circonstance, No. **13c** (1906): pp. 139–188.

Die Ostseefischerei in ihrer jetzigen Lage. (Dritter Teil.) IV. Uebersicht ueber die Seefischerei Finnlands, ausgearbeitet von J. A. Sandman. *Maps and Plates.*

Servia—Phytogeography. *Petermanns M.* **52** (1906): 169–173. **Adamović.**

Zur pflanzengeographischen Karte von Serbien. Von Prof. Dr. L. Adamović. *With Map.*

Noticed in the Monthly Record (January, p. 85).

Sweden—Norrland. **Högbom.**

Norrland; Naturbeskrifning. Af A. G. Högbom. (Norrländskt Handbibliotek. I.) Upsala, etc.: Almquist & Wiksell, [1906]. Size $10\frac{1}{2} \times 7\frac{1}{2}$, pp. xvi. and 414. *Maps and Illustrations. Price 6 kr. Presented by the Author.*

An exhaustive monograph on the province, its geology, geography, vegetation, animal life, etc., with an historical sketch illustrating the development of knowledge of it on the part of the outside world. It will be reviewed in a subsequent number.

Switzerland—Industries. *M. Antiquar. Ges. Zürich* **26** (1906): 155–210. **Lehmann.**

Zur Geschichte der Glasmalerei in der Schweiz. I. Teil: Ihre Entwicklung bis zum Schlusse des 14. Jahrhunderts. Von H. Lehmann. *With Illustrations.*

Switzerland—Settlements. *Ann. G.* **15** (1906): 329–352. **Brunhes and Girardin.**

Les groupes d'habitations du Val d'Anniviers comme types d'établissements humains. Par J. Brunhes et P. Girardin. *With Map and Illustrations.*

Turkey—Macedonia. **Struck.**

Makedonische Fahrten. Von A. Struck. I. Chalkidike. (Zur Kunde der Balkanhalbinsel. Reisen und Beobachtungen, herausgegeben von Dr. C. Patsch. Heft 4.) Wien und Leipzig: A. Hartleben, 1907 [1906]. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 88. *Maps and Illustrations. Price 2m. 25. Presented by the Publisher.*

United Kingdom. **Mackinder.**

Britain and the British Seas. By H. J. Mackinder. Second Edition. ('The Regions of the World' Series.) Oxford: Clarendon Press, 1907. Size 9×6, pp. xii. and 376. *Maps. Price 7s. 6d. net. Presented by the Publishers.*

Reviewed in the March number (p. 334).

United Kingdom—Devon. **Clayden.**

The history of Devonshire scenery: an essay in geographical evolution. By Arthur W. Clayden. London: Chatto & Windus (Exeter: J. G. Commin), 1906. Size $9 \times 5\frac{1}{2}$, pp. 202. *Maps and Illustrations. Price 10s. 6d. net.*

An attempt to reconstruct the geography of Devonshire at successive epochs in the past.

United Kingdom—Geology. *Quarterly J. Geol. S.* **62** (1906): 132–164. **Jukes-Browne.**

The Clay-with-Flints; its Origin and Distribution. By A. J. Jukes-Browne. *With Sections.*

The writer regards the "clay-with-flints" which often overlies the chalk, as in the main residual material derived from the "Reading beds" (Eocene), though some of its contents may have their origin in the chalk.

United Kingdom—Mersey. *P.R.S., Ser. A*, **78** (1906): 161–166. **Shoolbred.**

The Tidal Régime of the River Mersey, as affected by the recent dredgings at the Bar in Liverpool Bay. By J. N. Shoolbred. *With Plan.*

United Kingdom—South-West England. **Snell.**

The Blackmore Country. By F. J. Snell. London: A. & C. Black, 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. xxiv. and 288. *Map and Illustrations. Price 6s.*

Western Europe—Stone Age. *B.S.G. Com. Bordeaux* **32** (1906): 230–236. **Paniagua.**

Note sur le Moustérien dans l'Europe Occidentale. Par A. de Paniagua.

On the flint implement industry, known by the above name.

ASIA.

China—Sechuan. **Abendanon.**

La géologie du Bassin rouge de la province de Se-tchouan (Chine). Par E. C. Abendanon. The Hague: M. Nijhoff, 1906. Size 9½ × 6½, pp. 200. *Maps and Sections. Price 5s.*

A useful addition to our knowledge of the geological structure of the "Red basin" of Sechuan, based on the writer's personal observations, though account is, of course, taken of the work of Richthofen, Leclère, and others.

India—Central Provinces. **Russell.**

Central Provinces District Gazetteers. B. Volumes; Statistical Tables (1891–1901). Edited by R. V. Russell. Districts of Balaghat, Betul, Bhandara, Bilaspur, Chanda, Chhindwara, Damoh, Hoshangabad, Jubbulpore, Mandla, Nagpur, Narsinghpur, Nimar, Raipur, Saugor, Seoni, and Wardha. Allahabad, 1904–1905. Size 8½ × 6½. *Presented by the India Office.*

India—Himalaya. **Oestreich.**

Petermanns M., Ergänzungsheft 155 (1906): pp. viii. and 106.

Die Täler des nordwestlichen Himalaya. Beobachtungen und Studien von Dr. Karl Oestreich. *With Map and Illustrations.*

India—Historical. **Foster.**

The English factories in India, 1618–1621. A calendar of documents in the India Office, British Museum, and Public Record Office. By William Foster. Oxford: The Clarendon Press, 1906. Size 9 × 6, pp. xlviii. and 380. *Map. Price 12s. 6d. net. Presented by the Publishers.* [To be reviewed.]

India—Language. **Wickremasinghe.**

Marlborough's Self-taught Series, No. 19. Tamil Grammar Self-taught. (In Tamil and Roman characters.) By M. de Zilva Wickremasinghe. London: E. Marlborough, 1906. Size 7½ × 5, pp. 120. *Price 5s. Presented by the Publisher.*

India—Punjab. ———

Punjab District Gazetteers, vol. 13 A. Hoshiarpur District, Part A, 1904. Lahore, 1905. Size 10 × 7. *Maps. Presented by the Indian Government.*

Indian Ocean—Maldive Islands. *Indian Antiquary* 34 (1905): 251–252. **Perera.**

A Note on Maldivian History. By A. A. Perera.

Japan. **Papinot.**

Dictionnaire d'histoire et de géographie du Japon. Par E. Papinot. Tōkyō: Lib. Sansaisha; Yokohama, etc.: Kelly & Walsh. [1906.] Size 9 × 6, pp. xviii. and 992. *Maps (in separate cover) and Illustrations. Price 16s. 6d.*

The first attempt yet made to supply an encyclopædia of our knowledge of Japan. A considerable proportion of the headings are place-names.

Japan—Formosa. *J. Tokyo G.S.* 18 (1906): 246–257, 291–314. **Ōshima.**

A Sketch of Eastern Taiwan. By Jūrō Ōshima. *With Sketch-maps.* [In Japanese.]

Japan—Iwashiro. *J. Tokyo G.S.* 17 (1905): 882–888. **Tanaka.**

On the Lake Yukunakinuma, Iwashiro Province. By Akamaro Tanaka and Hirosaku Tanaka. *With Sketch-map and Diagrams.* [In Japanese.]

Japan—Lake Yamanaka. *J. Tokyo G.S.* 18 (1906): 165–176. **Tanaka.**

Lake Yamanaka. By Akamaro Tanaka. *With Sketch-maps, Illustrations, and Diagrams.* [In Japanese.]

Japan—Structure. *J. Tokyo G.S.* 18 (1906): 407–414. **Fukuchi.**

On the Fiji Volcanic Zone. By Nobuyo Fukuchi. [In Japanese.]

Japan—Volcanic Island. *J. Tōkyō G.S.* 17 (1905): 625–637, 702–727. **Satō.**

Geographical Trip to the New Sulphur Island. By Denzō Satō. *With Maps and Illustrations.* [In Japanese.]

Malay Archipelago—Sumatra. **Quast.**

Ts. Ind. Taal-, Land- en Volk. 48 (1906): 408–487.

Verslag nopens den politieken toestand in de Rokanstaatjes. Van H. C. E. Quast. *With Map.*

Russian Turkestan. *Abrégé B.S. Hongroise G.* 34 (1906): 96–105. **Prinz.**

Reiseskizzen aus Central-Asien. Von Dr. Julius Prinz. I. Aus Fergana in das Narin-Becken. (*Földrajzi Közlemények* 34 (1906): 215–224; *with sections.*)

Tibet. ———

Treaty Series; No. 9, 1906. Convention between the United Kingdom and China respecting Tibet. Signed at Peking, April 27, 1906. To which is annexed the Convention between the United Kingdom and Tibet, signed at Lhasa, September 7, 1904. London: Harrison & Sons, 1906. Size $9\frac{1}{2} \times 6$, pp. 8. *Price ½d.*

See note in the November number (vol. **28**, p. 506).

Turkey—Arabia. *G.Z.* **12** (1906): 425–439. **Kleist.**

England in Arabia. Von Oberleutnant v. Kleist.

Turkey—Palestine. **Ewing.**

Arab and Druze at home: a record of travel and intercourse with the people east of the Jordan. By William Ewing. London: T. C. & E. C. Jack, 1907. Size $8 \times 5\frac{1}{2}$, pp. xii. and 180. *Map and Illustrations. Price 5s. net. Presented by the Publishers.*

Gives the results of familiar intercourse with the peoples both east and west of the Jordan during a residence of over five years in Palestine.

Turkey—Syria. **Bel.**

The Desert and the Sown. By Gertrude Lowthian Bell. London: W. Heinemann, 1907. Size 9×6, pp. xvi. and 348. *Map and Illustrations. Price 16s. net. Presented by the Publisher.* [Reviewed, *ante*, p. 445.]

Western Asia—Trade-routes. **Schlagintweit.**

Verkehrswege und Verkehrsprojekte in Vorderasien. Von Max Schlagintweit. (Schriften der Deutsch-Asiatischen Gesellschaft . . '. 2 Heft.) Berlin: Hermann Paetel, 1906. Size 9×6, pp. 42. *Map. Price 1s.*

AFRICA.

Africa—British Colonies. ———

Colonial Reports, Annual, No. 500. The Surveys and Explorations of British Africa. The Annual Report of the Colonial Survey Committee. First Year: To August, 1906. London, 1906. Size $9\frac{1}{2} \times 6$, pp. 52. *Maps and Illustrations. Price 2s. 7d.*

Africa—Zoology. ———

Correspondence relating to the Preservation of Wild Animals in Africa. London, 1906. Size $13 \times 8\frac{1}{2}$, pp. xxiv. and 392. *Maps. Price 4s.*

Central Africa. **Lemaire.**

Tra Mez-Afriko. (A travers l'Afrique centrale.) Par le Commdt. Ch. Lemaire. [In French and Esperanto.] Size $11 \times 8\frac{1}{2}$, pp. 86. *Map and Illustrations. Presented by the Author.*

An account of Major Lemaire's journey given before the Geneva Esperanto Congress in September, 1906.

Congo State *B.S.G. Italiana* **7** (1906): 963–978. **Cordella.**

Appunti sulla zona del Maniema (Riva sinistra del Lualaba), del capitano Ernesto Cordella.

Congo State. *Z. Ges. Erdk. Berlin* (1906): 426–431, 493–497. **Frobenius.**

Leo Frobenius' Forschungsreise in das Kassai-Gebiet. III. and IV. Bericht. Von L. Frobenius.

See *Journal*, **28**, 181 and 508.

Congo State. ———

État Independant du Congo. Annales du Musée du Congo. Ethnographie et Anthropologie.—Série III. Notes Analytiques sur les Collections Ethnographiques du Musée du Congo. Tome I.—Fasc. II. La Réligion. Bruxelles: Spineux et Cie., 1906. Size $14\frac{1}{2} \times 12$, pp. 145–316. *Plates.*

Egyptian Sudan. *B. Comité Afrique Française* **16** (1906): 189–194. **Mézières.**

Mission Bonnel de Mézières. Au Soudan Anglo-Égyptien. Par A. Bonnel de Mézières.

Report on the general position in the Sudan.

German East Africa. *Z. Kolonialpolitik, etc.* **8** (1906): 665–695. **Most.**

Die wirtschaftliche Entwickelung Deutsch-Ostafrikas, 1885–1905. Von Karl Most.

German East Africa. **Fülleborn.**

Das Deutsche Njassa- und Ruwuma- Gebiet, Land und Leute, nebst Bemerkungen über die Schire-Länder. Mit Benutzung von Ergebnissen der Njassa- und

Kingagebirgs-Expedition der Hermann und Elise geb. Heckman Wentzel-Stiftung verfasst von Dr. Friedrich Fülleborn. (Deutsch-Ost-Africa, . . . Band IX.) Berlin: D. Reimer, 1906. Size 11 × 7½, pp. xx. and 636. *Illustrations, Maps and Plates in separate Atlas*, size 17 × 12. *Price* (*volume*) 60m., *and* (*Atlas*) 65m. *Presented by the Publisher*. [To be reviewed.]

German South-West Africa—Ethnology. **Bayer.**
Z. Kolonialpolitik, etc. 8 (1906): 625–648.
Die Nation der Bastards. Von Bayer. *With Map and Illustrations.*

German South-West Africa. *M. Deutsch. Schutzgebieten* 19 (1906): 257–273. **Schulze.**
Zwischen Lüderitzbucht und Kubub. Von Hauptmann Schulze. *With Maps and Illustrations.*

Gold Coast. **Crowther.**
Quarterly J.I. Com. Research Tropics, Liverpool University 1 (1906): 167–182.
Notes on a District of the Gold Coast. By F. Crowther. *With Maps.*

Ivory Coast. **Clozel.**
F.-J. Clozel. Dix ans à la Côte d'Ivoire. Paris: A. Challamel, 1906. Size 11½ × 7½, pp. 350. *Maps and Illustrations. Price* 12s. 6d. [To be reviewed.]

Morocco. *Renseignements Col., Comité Afrique Française* (1906): 227–234. **Buchet.**
Mission Buchet. Rapport sommaire d'ensemble. Par G. Buchet.

The author carried out trigonometrical surveys in North-West Morocco, besides making geological, zoological, ethnological, and other observations.

Morocco—Railways. *B.R.S.G. Madrid, Rev. G. Col.* 3 (1906): 399-408. **Faria.**
Futuros ferrocarriles de Marruecos. Por P. G. Faria.

Portuguese East Africa. **Cairncross.**
B.S.G. Lisboa 24 (1906): 22–30, 50–54, 88-91, 181–185.
A região de Manica. Por W. M. Cairncross; traduzido por João Farmhouse.

Portuguese East Africa. **Maugham.**
Portuguese East Africa. The History, Scenery, and Great Game of Manica and Sofala. By R. C. F. Maugham. London: John Murray, 1906. Size 9 × 6, pp. xii. and 340. *Map and Illustrations. Price* 15s. *net. Presented by the Publisher.*

See review in the February number (p. 216).

Portuguese East Africa. *B.S.G. Lisboa* 24 (1906): 111–128, 147–160. ———
Estatistica em paizes não civilisados. Territorio de Manica e Sofala.

Portuguese East Africa. ———
Guia Postal do Territorio de Manica e Sofala sob a Administração da Campanhia de Moçambique. Beira, 1906. Size 8½ × 6, pp. viii. and 156. *Illustration. Presented by the Companhia de Moçambique.*

Portuguese East Africa. **Machado.**
B.S.G. Lisboa 24 (1906): 33-50, 65–87.
Arterias de Communicação nos districtos de Sofala e Manica. Por Carlos Roma Machado. *With Map.*

Rhodesia. **Randall-MacIver.**
Mediæval Rhodesia. By David Randall MacIver. London: Macmillan & Co., 1906. Size 11½ × 9, pp. xvi. and 106. *Illustrations. Price* 20s. *net. Presented by the Publishers.* [Reviewed July, 1906, p. 68.]

St. Helena. **Dehérain.**
La prise de possession de Sainte-Hélène par la Grande-Bretagne au XVII^e Siècle. Par H. Dehérain. Paris: Imp. Nationale, 1906. Size 11 × 9, pp. 16. *Presented by the Author.*

San Thomé. *B.S.G. Lisboa* 211 (1906): 97-110. **Strunk.**
Relatorio do Dr. Strunk sobre una viagem a S. Thomé. (Traduzido e communicado pelo Sr. Salema Barbosa.)

South Africa. **Handley.**
Briton, Boer, and Black; or, Ten Years' Hunting, Trading, and Prospecting in South Africa. By Clement Handley. London: T. Sealey Clark. 1906. Size 8½ × 5½, pp. xvi. and 342. *Illustrations. Price* 10s. 6d. *net. Presented by the Publisher.*

Gives some insight into life on the outskirts of civilization in South Africa. The author was farming in the Transvaal at the time of the Jameson raid, of which he gives some details from personal knowledge.

South Africa—Historical. *P. Rhodesia Sc. Ass.* **5** (1905): 40–54. **Torrend.**
The Sabæans on the Zambesi. By Rev. J. Torrend. *With Map.*

South Africa—Kalahari. *P. Rhodesia Sc. Ass.* **5** (1906): 29–40. **Wilson.**
The Northern Kalahari Desert. By W. Wilson.

West Africa—Boundary. *M. Deutschen Schutzgeb.* **19** (1906): 181–256. **Ambronn.**
Berichte über die astronomischen und geodätischen Aufnahmen, welche zum Zwecke der Grenzregulierung zwischen Kamerun und dem Congo-Français in den Jahren 1900 bis 1902 ausgeführt wurden. Bearbeitet mit Benutzung der Berichte des Expeditionsleiters Herrn Hauptmann Engelhardt von Prof. Dr. L. Ambronn. *With Maps.*

NORTH AMERICA.

Arizona and Mexico. *Science* **24** (1906): 116–118. **Merrill.**
Evidences of Glaciation in Southern Arizona and Northern Sonora. By Dr. F. J. Merrill.

Canada—Guide-book. **Baedeker.**
The Dominion of Canada, with Newfoundland and an expedition to Alaska. Handbook for travellers by Karl Baedeker. Third revised and augmented edition. London: Dulau & Co., 1907. Size $6\frac{1}{2} \times 4$, pp. lxiv. and 332. *Maps and Plans. Price 6 marks. Presented by the Editor.*

The second edition was published in 1900, and the rapid development of Canada within the past half-dozen years renders the appearance of a third particularly welcome.

North America—Vegetation. **Wiesner.**
Sitzb. K.A.W. Wien **114** (Ab. I.) (1905): 77–150.
Untersuchungen über den Lichtgenuss der Pflanzen im Yellowstonegebiete und in anderen Gegenden Nordamerikas. Photometrische Untersuchungen auf pflanzenphysiologischem Gebiete (V. Abhandlung) von J. Wiesner.
See note in vol. **26**, p. 459.

United States—California. *Popular Sc. Monthly* **69** (1906): 69–75. **Ashley.**
The geological prelude to the San Francisco earthquake. By Geo. H. Ashley. *With Sketch-maps and Diagrams.*

United States—Cotton. ——
Cotton Production and Statistics of Cottonseed Products. 1905. (Dept. of Commerce and Labor. Bureau of the Census, Bulletin 40.) Washington, 1906. Size $11\frac{1}{2} \times 9$, pp. 72. *Maps.*

United States—Earthquakes. *Popular Sc. Monthly* **69** (1906): 76–86. **Fuller.**
Our greatest earthquakes. By Myron Leslie Fuller. *With Illustrations.*

United States—Michigan. *J. Geology* **14** (1906): 411–424. **Goldthwait.**
Correlation of the raised beaches on the west side of Lake Michigan. By James Walter Goldthwait. *With Sketch-map, Profile, and Illustrations.*

United States—Mississippi. *Popular Sc. Monthly* **69** (1906): 248–256. **Brown.**
The Protection of the Alluvial Basin of the Mississippi. By Robert Marshall Brown. *With Sketch-maps and Profiles.*
Based largely on the reports of the Mississippi River Commission.

CENTRAL AND SOUTH AMERICA.

Paraguay. **Decoud.**
Geografía de la República del Paraguay. Por Héctor F. Decoud. 5ª Edición. Leipzig, 1906. Size 8×6, pp. 128. *Map and Illustrations. Presented by the Consul-General for Paraguay.*

Paraguay. **Vallentin.**
Paraguay: das Land der Guaranís. Von Dr. Wilhelm Vallentin. Berlin: H. Paetel, 1907. Size 10×7, pp. viii. and 324. *Illustrations. Price 6s.*

Description of a journey in Paraguay, embodying a good deal of practical information on the present position of the country and its resources.

Peru—Minerals. *B. Cuerpo Ingen. Minas, Perú*, No. 35 (1906): pp. 120. **Dueñas.**
Recursos minerales de las provincias de Jauja y Huancayo. Por E. I. Dueñas. *With Map and Illustrations.*

Peru—Minerals. *B. Cuerpo Ingenieros Minas, Peru*, No. 29 (1905): pp. 100. **Fuchs.**
La Región Cuprífera de los Alrededores de Ica y Nazca. Por Federico G. Fuchs. *With Map and Sections.*

South America—German Colonies. *Z. Kolonialpolitik, etc.* 8 (1906): 436–440. **Klössel.**
Deutsche Kolonisation in Südamerika. Von M. Hans Klössel.

AUSTRALASIA AND PACIFIC ISLANDS.

Bismarck Archipelago. **Stephan.**
Südseekunst. Beiträge zur Kunst des Bismarck-Archipels und zur Urgeschichte der Kunst überhaupt. Herausgegeben von Dr. Emil Stephan. Berlin: Dietrich Reimer, 1907. Size 11 × 7, pp. 16* and 146. *Map and Illustrations. Price 6s.*

Bismarck Archipelago. **Stephan and Graebner.**
Neu-Mecklenburg (Bismarck-Archipel). Die Küste von Umuddu bis Kap St. George. Forschungsergebnisse bei den Vermessungsfahrten von S. M. S. Möwe im Jahre 1904. Herausgegeben von Dr. Emil Stephan und Dr. Fritz Graebner. Berlin: Dietrich Reimer, 1907. Size 11 × 7, pp. 12* and 242. *Map and Illustrations. Price 12s.*

These two works will be reviewed in a later number.

New Hebrides. **Bourge.**
Georges Bourge. Les Nouvelles Hébrides de 1606 à 1906. Paris: A. Challamel, 1906. Size 7½ × 5½, pp. 288. *Illustrations. Price 3s. 9d.*

A useful summary of our knowledge of the group, and of the history of European relations with it.

New Zealand—Botany. **Cockayne.**
Notes on the Subalpine Scrub of Mount Fyffe (Seaward Kaikouras). By L. Cockayne, PH.D. (From *Transactions of the New Zealand Institute*, vol. 38, 1905.) Size 8½ × 5½, pp. 361–374.

New Zealand—Poor Knights Islands. **Cockayne.**
Notes on a brief botanical visit to the Poor Knights Islands. By L. Cockayne, PH.D. (From *Transactions of the New Zealand Institute*, vol. 38, 1905.) Wellington, 1906. Size 8½ × 5½, pp. 351–360.

These two papers have been noticed in the Monthly Record (January, p. 92).

Pacific Islands. *Z. Ges. Erdk. Berlin* (1906): 323–346, 385–404. **Arldt.**
Parallelismus der Inselketten Ozeaniens. Von Dr. T. Arldt. *With Map.*

Noticed in the *Journal* for November, 1906 (p. 511).

Samoa—Tutuila. *J. of G.* 5 (1906): 18–26. **Kellogg.**
American Samoa. By Vernon L. Kellogg. *With Illustrations.*

South Australia. **George.**
South Australia. Report of Mr. F. R. George on his Prospecting Expedition North of Nullarbor Plains. Adelaide, 1905. Size 13½ × 8½, pp. 4. *Map.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geophysics. *Science* 24 (1906): 301–303. **See.**
The Nature and Origin of Volcanic Heat. By Dr. T. J. J. See.

The writer believes in a fluid substratum beneath the solid crust, and that one common cause producing motion just at this depth underlies earthquakes, volcanoes, the formation of mountains, and other allied phenomena. He postpones, however, the development of his views to a future occasion.

Geophysics. *P.R.S., Ser. A.* 78 (1906): 150–153. **Strutt.**
On the Distribution of Radium in the Earth's Crust. Part ii. Sedimentary Rocks. By the Hon. R. J. Strutt.

Glaciology. *J. Geology* 14 (1906): 402–410. **Reid.**
The Variations of Glaciers. XI. By Harry Fielding Reid.

Summary of the tenth annual report of the International Committee.

Gravity. *Sitzb. K.A.W. Wien* 114 (Ab. IIa.) (1905): 695–710. **Spitaler.**
Periodische Verschiebungen des Schwerpunktes der Erde. Von Prof. Dr. R. Spitaler.

Hydrology. **Andrimont.**

La science hydrologique; ses méthodes, ses récents progrès, ses applications. Par René d'Andrimont. Paris, etc.: Ch. Béranger, 1906. Size 9 × 6, pp. 116. *Diagrams. Price 4s.*

A concise and useful summary of our knowledge of the circulation of water, both on land and in the ocean, and of modern methods of research on the subject.

Kumatology. *B. Musée Océanographique Monaco*, No. 57 (1906): pp. 18. **Berget.**

La houle et les vagues. Par A. Berget.

Limnology—Temperature. *Petermanns M.* **52** (1906): 184–186. **Aufsess.**

Eine photographische Methode zur Bestimmung des Eindringens der Wärmestrahlung in einer See. Von Dr. Otto Frhr. v.u.z. Aufsess. *With Illustrations.*

Meteorology. *Sitzb. K.A.W. Wien* **114** (Ab. IIa.) (1905): 1271–1292. **Exner.**

Ueber Druck und Temperatur bewegter Luft. Von Dr. F. M. Exner.

Meteorology. *Sitzb. K.A.W. Wien* (Ab. IIa.) (1905): 1519–1568. **Samec.**

Durchsichtigkeit der Luft bei verschiedenen Witterungszuständen in Wien. Von Dr. M. Samec. *With Diagrams.*

Meteorology—Dustfalls. *Beiträge Geophysik* **8** (1906): 7–42. **Krebs.**

Staubfälle, besonders im Passatgebiet des Nordatlantik. (Neue Folge.) Von W. Krebs.

Meteorology—Solar radiation. **Hopfner.**
Sitzb. K.A.W. Wien **114** (Ab. IIa.) (1905): 1315–1357.

Die Verteilung der solaren Wärmestrahlung auf der Erde. Von Dr. F. Hopfner.

Mathematical discussion of the latitudinal and seasonal distribution of solar heat on the Earth's surface.

Meteorology—Wind. **Simpson and others.**

The Beaufort Scale of Wind-force. Report of the Director of the Meteorological Office upon an Inquiry into the relation between the estimates of wind-force according to Admiral Beaufort's scale and the velocities recorded by Anemometers belonging to the office. With a Report upon certain points in connection with the Inquiry, by G. C. Simpson, M.SC., and Notes by Sir G. H. Darwin, K.C.B., W. H. Dines, F.R.S., and Commander Campbell Hepworth, C.B. London: Wyman & Sons, 1906. Size 12 × 10, pp. 54. *Diagrams. Price* 1s. 6d.

Meteorology—Wind-transport. *Deutsch. Rundschau G.* **28** (1906): 442–447. **Krebs.**

Staub-, Vogel- und Insekten-Transporte durch Luftströmungen, besonders aus der westlichen Sahara. Von W. Krebs. *With Map.*

Ocean and Climate. *J. of Geology* **14** (1906): 363–373. **Chamberlin.**

On a possible reversal of deep-sea circulation and its influence on geologic climates. By T. C. Chamberlin.

Oceanography—Atlantic. *B.R.S.G. Madrid, Rev. G. Col.* **3** (1906): 384–390. **Vera.**

Formación de tierras en el seno de las aquas. Nuevas islas Canarias saliendo del fondo del Atlántico. Por V. Vera.

Oceanography—Museum. *Z. Ges. Erdk. Berlin* (1906): 257–266. **Dinse.**

Das neue Museum für Meereskunde in Berlin. Von Dr. P. Dinse.

Oceanography—North Sea. *Z. Ges. Erdk. Berlin* (1906): 482–489. **Brühl.**

Die zweite Studienfahrt des Instituts für Meereskunde zu Berlin. Von Dr. L. Brühl.

Phytogeography—Algæ. **Mangin.**
B. Musée Océanographique Monaco, No. 82 (1906): pp. 34.

Distribution des Algues: algues fixées, algues du Plankton. Par L. Mangin. *With Charts and Illustrations.*

Seismology. *Sitzb. K.A.W. Wien* **114** (Ab. IIa.) (1905): 1407–1430. **Benndorf.**

Ueber die Art der Fortpflanzung der Erdbebenwellen im Erdinnern. Von Dr. H. Benndorf.

Seismology. *Abrégé B.S. Hongroise G.* **34** (1906); 26–34. **Pécsi.**

Grundzüge der geometrischen Theorie der Erdbeben. Von Dr. Albert Pécsi. (*Földrajzi Közlemények* **34** (1906): 53–62, *with Diagrams.*)

Volcanoes. *Popular Sc. Monthly* 68 (1906): 453–550. **Dutton.**
Volcanoes and Radioactivity. By Major C. E. Dutton.

Volcanoes. *Petermanns M.* 52 (1906): 165-167. **Krebs and Sapper.**
Ueber Beziehungen des Meeres zum Vulkanismus. Von W. Krebs und Prof. Dr. K. Sapper.

Zoogeography—Fishes. **Strodtmann.**
Arbeiten der Deutschen wissenschaftlichen Kommission für die internationale Meeresforschung. B. Aus der Biologischen Anstalt auf Helgoland. No. 4. Laichen und Wandern der Ostseefische. II. Bericht. Von S. Strodtmann. Oldenburg i Gr., 1906. Size 13 × 11, pp. 137-216. *Map. Presented by the Commission.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Schlüter.**
Die Ziele der Geographie des Menschen. Von Otto Schlüter. München, etc.: R. Oldenburg, 1906. Size 8½ × 5½, pp. 64. *Price* 1.20*m*. *Presented by the Publisher.*

Anthropology. **[Kingsford.]**
Anthropological Photographs. Report of the Committee . . . appointed for the Collection, Preservation, and Systematic Registration of Photographs of Anthropological Interest. (Drawn up by the Secretary.) [British Association, Section H; York, 1906.] Size 8½ × 5½, pp. 18.

Contains a first list of photographs registered.

Colonisation. *J. of G.* 5 (1906): 11-17. **Hubbard.**
The Industrial and Commercial Importance of a Tropical Possession. By George D. Hubbard.

Commercial—Cocoa. *Ann. G.* 15 (1906): 289-298. **Chevalier.**
Le cacao. Sa production et sa consommation dans le monde. Par A. Chevalier.

Commercial—Petroleum. **Redwood.**
Petroleum: a Treatise on the Geographical Distribution and Geological Occurrence of Petroleum and Natural Gas; the Physical and Chemical Properties, Production, and Refining of Petroleum and Ozokerite, the Characters and Uses, Testing, Transport, and Storage of Petroleum Products, and the Legislative Enactments relating thereto: together with a Description of the Shale Oil and allied Industries; and a full Bibliography. By Sir Boverton Redwood. Second Edition. 2 vols. London: Charles Griffin & Co., Ltd., 1906. Size 9 × 6, pp. xxxii. and 1064. *Maps and Illustrations. Price* 45*s. net. Presented by the Publishers.* [To be reviewed.]

Historical. **Blázquez.**
Antonio Blázquez. Los Manuscritos de los Comentarios al Apocalipsis de San Juan por San Beato de Liébana. (De la Revista de Archivos, Bibliotecas y Museos.) Madrid, 1906. Size 10 × 7, pp. 18. *Facsimile Map. Presented by the Author.*

On the MSS. (twenty-five in all) of the work containing the famous "Beatus" map, which, as shown by K. Miller, was the type of a whole group of early maps.

Historical—Columbus. **Young.**
Christopher Columbus and the New World of his discovery. A narrative by Filson Young, with a note on the navigation of Columbus's first voyage by the Earl of Dunraven. 2 vols. London: E. Grant Richards, 1906. Size 9 × 6, pp. (vol. 1) xxii. 324; (vol. 2) x. 400. *Maps and Illustrations. Price* 25*s. net.*

This makes no claim to be the result of original research, but aims at gathering up, for the benefit of the general public, the results of the studies of experts on Columbus and his work, which have appeared within recent years. In the case of points still under dispute, *e.g.* the question of the forgery of the Toscanelli correspondence, no great attempt is made to sift the evidence from an independent standpoint.

Historical—Exploration. **Williams.**
The Romance of Early Exploration; with descriptions of Interesting Discoveries, Thrilling Adventures, and Wonderful Bravery of the Early Explorers. By Archibald Williams. London: Seeley & Co., 1907 [1906]. Size 8 × 5, pp. 346. *Sketch-maps and Illustrations. Price* 5*s. Presented by the Publishers.*

Brings out, as is indicated by the title, the side of early travel which specially

appeals to the imagination. The facts appear, however, to have been collected with care.

Historical—Ophir. *Asiatic Quarterly Rev.* **22** (1906): 118-130. **McNair.**
Ophir. By J. F. A. McNair.

The author is inclined to put the gold region in the Malay peninsula.

Historical Geography. *J. Manchester G.S.* **22** (1906): 56-64. **Dann.**
Orography and History. By E. W. Dann.

History of Geography. *G.Z.* **12** (1906): 440-449. **Berger.**
Die ältere Zonenlehre der Griechen. Von Hugo Berger.

Military Geography. *J.R. Artillery* **33** (1906): 229-252. **May.**
Geography in relation to War. By Colonel E. S. May, C.B., etc. *With Sketch-maps.*

Sociology—Jews. *Popular Sc. Monthly* **69** (1906): 257-267. **Fishberg.**
The Jews: a Study of Race and Environment. By Maurice Fishberg.

BIOGRAPHY.

Rennell. **Frenzel.**
Major James Rennell, der Schöpfer der neueren Englischen Geographie. Ein Beitrag zur Geschichte der Erdkunde. Inaugural-Dissertation . . . von Curt Arthur Frenzel. Pulsnitz, 1904. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. viii. and 196. *Portrait. Presented by the Author.*

A careful and complete account of the geographical work of Rennell.

GENERAL.

British Colonies. **Lucas.**
A Historical Geography of the British Colonies. By C. P. Lucas. Vol. 1: The Mediterranean and Eastern Colonies. Second Edition, revised and brought up to date by R. E. Stubbs. Oxford: Clarendon Press, 1906. Size $7\frac{1}{2} \times 5$, pp. viii. and 304. *Maps. Price 5s. net.*

This volume has been subjected to a very thorough revision, the editor having been aided throughout by local experts of the Colonial Service.

Educational. **Morgan.**
The Practical Teaching of Geography in Schools and Colleges. By Dr. Alex. Morgan. Fourth Edition. London: G. Philip & Son, 1906. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. 18. *Diagrams. Price 6d. net. Presented by the Publishers.*

Educational—Methods. *J.G.* **5** (1906): 97-108. **Goode.**
Laboratory Work with the Sun. By J. Paul Goode. *With Diagrams.*

Describes methods of solving problems by the help of an instrument designed by the writer, and called by him a "Sun-board."

Geography. *J. of G.* **5** (1906): 1-10. **Brown.**
Geographical Changeableness. Some Characteristics and Values. By Robert Marshall Brown.

Urges the need of modifying geographical conceptions with the advance of knowledge.

Marseilles Geographical Society. **Léotard and Guillaumet.**
B.S.G. Marseille **30** (1906): 1-112.
Histoire de la Société (1786-1906. Par J. Léotard.—Table Générale des Matières du Bulletin (1877-1905). Par J. Léotard, et A. Guillaumet. *With Illustrations.*

Travel. **Jerningham.**
From East to West. Notes by the way. By Sir Hubert Jerningham, K.C.M.G. London: J. Murray, 1907. Size 9×6, pp. xiv. and 352. *Maps and Illustrations. Price 15s. net. Presented by the Publisher.*

Narrative of a voyage to Japan, to which country the bulk of the work is devoted (see note on p. 454, *ante*).

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Belgium. **Institut Cartographique Militaire.**

Carte de la Flandre Occidentale, 1906. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. 4 sheets. Brussels: Institut Cartographique Militaire, 1906.

A useful general map of the country between Ostend and Bruges and the districts to the south as far as Lille. It is printed in colours, and special attention has been given to canals, roads, and railways.

British Isles. **Bartholomew.**

Bartholomew's contour motoring map of the British Isles, showing the best touring roads with heights and distances. Reduced by permission from the Ordnance Survey. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Edinburgh: John Bartholomew & Co., [1907]. *Price 5s. net. Presented by the Publisher.*

On this map land under 250 feet in altitude is uncoloured, after which the relief is indicated by four tints of brown, ranging as follows: 250 to 500, 500 to 1000, 1000 to 2000, and above 2000 feet. In addition to the tinting, heights of important points are given in figures. Roads are shown in red, and other information specially valuable to motorists, such as places with garages, hotels, etc., are given by symbols. Figures in red indicate distances between places which are marked by black dots. There are inset plans, on enlarged scales, of the environs of London, Manchester, Glasgow, and Dublin, as well as useful tables of distances.

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from February 1 to 28, 1907.

1 inch—(third edition):—

In outline, sheets 247, 279, 280. 1*s. each* (engraved).
With hills in brown or black, 71, 73, 121, 138. 1*s. each* (engraved).

6-inch—County Maps (first revision):—

Carmarthenshire, 23 N.E. **Devonshire,** 39 S.W., 51 S.W., 62 N.W., 74 N.E., S.E., 75 N.E., 88 S.W., 105 N.W., N.E., S.E., 112 S.W., 120 N.W., 131 S.W., 132 N.E., S.E., 133 N.E., S.W., 134 N.W. **Lincolnshire,** 43 N.E., S.E., 44 N.W., 51 S.E., 52 N.W., S.E., 53 N.W., S.W., S.E., 54 N.W., S.E., 55 S.E., 56 N.E., 57 N.E., S.E., 60 N.E., 62 S.W., 63 S.E., 64 S.W., S.E., 65 N.W., N.E., S.W., 66 N.W., N.E., S.W., 67 S.W., 73 S.E., 74 S.E., 75 S.W., 88 S.W. **Norfolk,** 7 S.W., S.E., 11 N.W., 17 N.E., 18 S.W., 22 S.W., 24 S.E., 25 S.E., 30 N.W., 36 S.W., S.E., 40 N.E., 41 N.W., 48 N.W., 49 N.E., 60 S.E., 61 S.W., 85 N.W., N.E., S.E., 91 S.E., 101 N.E. **Pembrokeshire** (1 S.W. and 2 N.W.), (1 S.E. and 2 N.E.), (2 N.W. and 1 S.W.). (2 N.E. and 1 S.E.), 3 S.W., 7 N.W. **Suffolk,** 5 S.E., 11 N.W., N.E., S.W., 20 N.W., S.W., S.E., 31 N.E., S.E., 32 S.W., 42 N.E., S.E., 43 S.W., 52 N.E., S.W., S.E., 53 N.W., S.W., 61 N.W., S.W., 70 N.W., 79 N.W. **Yorkshire (First** Revision of 1891 Survey), 272 S.W., 273 S.E., 274 N.E., 275 N.E., S.W., 276 N.W. 1*s. each.*

25-inch—County Maps (first revision):—

Carmarthenshire, XXI. 12, 14, 15, 16; XXVIII. 3, 4, 12, 16; XXIX. 1, 4, 5, 6, 8, 9, 13; XXXVI. 4; XXXVII. 1, 6, 7, 10, 11, 12, 15; XLIV. 3; LI. 2, 6; LIII. 16; LIV. 15; LVII. 4, 8; LVIII. 7, 10, 11; LIX. 1, 5, 9, 13. 3*s. each.* XX. 16. 1*s.* 6*d.* **Cornwall,** VII. 12, 16; X. 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 16; (XIII. 4 and XIV. 1), (XIII. 8 and XIV. 5), XIII. 12 (14, 15, 16); (XIII*a*. 16 and XVIII. 3, 4); (XIV. 1 and XIII. 4), (XIV. 5 and XIII. 8); (XVIII. 3, 4, and XIII*a*. 16), XVIII. (7 and 8), XVIII. 11, 12, 13, 14; XXVIII. 13, 14; XXIX. 14; XXXV. 2, 3, 4, 6, 7. 8, 10, 11, 12, 14, 15, 16; XXXVI. 1, 2, 3, 5, 7, 10, 11, 13, 14, 15; XLIII. 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; XLIV. 1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 16; LV. 10, 14. **Devonshire,** CXVII. 14, 15; CXXIII. 3, 4, 8, 11, 12; CXXIV. 1, 5, 9, 13. **Kent** (Second Revision), XXXVII. 15; XLVIII. 2, 3, 6, 7, 8, 10, 11, 12, 14, 15; LVIII. 2. 3*s. each.* **Lancashire** (First Revision of 1891 Survey), CXI. 4. **Lincolnshire** (First Revision), XXIV. 11, 12, 16; XXV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XXVI. 3, 6, 7, 11, 15, 16; XXVII. 8, 9; XXVIII. 2, 3, 4, 5, 10,

16; XXIX. 8, 9, 12, 13, 16; XXX. 3, 12, 13, 14; XXXV. 1; XL. 10. **3s. each.** XXIV. 4, 7. **1s.** *6d. each.* **Norfolk**, LXV. 6, 10, 11; LXXV. 9, 10; LXXVII. 3; LXXXIX. 5, 6; **Pembrokeshire**, VII. 9, 10, 13, 14; XI. 12, 16; XII. 1, 2, 5, 6, 9, 10, 11, 12, 13, 14, 15; XVIII. 1, 2, 3, 4; XIX. 1, 2, 3, 5. **3s.** *each.* XII. 16. **1s. 6d.** **Yorkshire** (First Revision of 1891 Survey), CCXXII. 10, 14; CCXXXVII. 2, 3, 5, 6, 7, 8, 10, 11, 12, 14, 15; CCXXXVIII. 1, 2, 5, 9, 10, 11, 12, 14, 15; CCXLVIII. 3, 7, 8, 9, 10, 13, 16.

(*E. Stanford, London Agent.*)

England and Wales. **Geological Survey.**

1-inch—New Series. Colour printed. Newquay (Drift edition), 346; Falmouth and Truro, 352. **1s.** *6d. each.*

6-inch—Uncoloured. Glamorgan, 17 N.W., N.E., S.W., 35 S.W. **1s. 6d.** *each.*

(*E. Stanford, London Agent.*)

England—Berkshire. **Ordnance Survey.**

Berkshire, showing schools. Prepared for the County Education Committee. Scale 1 : 63,360 or 1 inch to 1 stat. mile. 2 sheets. Southampton: Ordnance Survey Office, 1906. *Presented by the Berkshire Education Committee.*

Consists of the uncoloured one-inch Ordnance Survey sheets of Berkshire, joined as one map, with special information added concerning schools. By different symbols in red are indicated voluntary schools, council schools, disused schools, elementary schools receiving no grants, secondary schools, and voluntary schools transferred to the council. The boundaries of the county and parishes are shown by red lines.

Germany. **Höck.**

Versuch einer pflanzengeographischen Einteilung und Umgrenzung Norddeutschlands. Scale 1 : 3,700,000 or 1 inch to 58·4 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 2. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilungen der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets (coloured) 293, Potsdam; 296, Frankfurt-a-O. Berlin. K. Preussische Landesaufnahme, 1906. *Price* **1.50***m. each sheet.*

Norway. **Norges Geografiske Opmaaling.**

Generalkarte over det sydlige Norge. Scale 1 : 400,000 or 1 inch to 6·3 stat. miles. Sheet XV. *Price* 0.60 *kr. each sheet.* Topografisk kart over Kongeriget Norge. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 10 C, Sarpsborg; 25 D, Lillehammer; 31 B, Gausdal; 38 D, Nordre Fæmund; 46 D, Trondhjem; K 11, Steigen; K 12, Kjerringö; K 13, Bodö; M 9, Ofoten; V 1, Hjelmsö; V 8, Noarvas; V 9, Njullas; W 8, Hugstfjeld; Y 3, Vestertana; Æ 3, Baasfjord. *Price* 0.60 *kr. each sheet.* Christiania: Norges Geografiske Opmaaling, 1906. *Presented by the Norwegian Geographical Institute.*

Turkey. **Topographical Section, General Staff.**

Map of Turkey. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet, Adrianople. London: Topographical Section, General Staff, War Office, 1906. *Price* **2s. 6d.** *net. Presented by the Director of Military Operations.*

AFRICA.

Egypt. **Egyptian Survey Department.**

Topographical Map of Egypt. Scale 1 : 50,000 or 1·6 inch to 1 stat. mile. Sheets: S.E. XIX.-VI. and VII.; XXI.-VIII. Giza: Survey Department, 1906. *Presented by the Director-General, Egyptian Survey Department.*

The first of these sheets includes the area extending from 26° to 26° 30′ N. lat., and 32° 30′ to 32° 40′ E. long., and the second that from 25° 50′ to 26° N. lat., and 32° 45′ to 33° E. long.

Gambia. **Topographical Section, General Staff.**

Gambia, reproduced from the work of the Anglo-French Boundary Commission, 1904–1905. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Compiled in the

Topographical Section, General Staff. 2 Sheets. London: Topographical Section, General Staff, War Office, 1906.

The basis of this map is the extensive plane-table surveys of Major E. L. Cowie, the Chief British Commissioner for the boundary, and his assistant, Mr. A. B. B. de Tscharner, which has been adjusted by astronomical determinations.

German East Africa. **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika. Begonnen unter Leitung von Dr. Richard Kiepert, fortgesetzt unter Leitung von Paul Sprigade und Max Moisel. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: E 2, Bismarckburg; F 2, Kalambo-Mundung; F 3, Neu-Langenburg. Berlin: Dietrich Reimer (Ernst Vohsen), 1906. *Presented by Herr Max Moisel.*

These are important sheets including the country adjacent to the Anglo-German boundary between Lakes Nyasa and Tanganyika.

Kamerun. **"Petermanns Mitteilungen."**

Die Entwickelung der Nordgrenze von Kamerun. Scale 1 : 6,000,000 or 1 inch to 94·7 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 3. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

Senegal. **Service Géographique de l'Afrique Occidentale Française.**

Carte de Sénégal. Levé par les Officiers du Service Géographique de l'Afrique Occidentale Française. Scale 100,000 or 1 inch to 1·6 stat. mile. Sheets: 3, N'Diago; 4, Ross; 7, St. Louis. Paris: Service Géographique de l'Armée, [1906]. *Price 2 fr. each sheet.*

Three sheets of a large-scale map of Senegal, the first issue of which appeared two years ago. Relief is shown by brown contour-lines at intervals of 10 metres, and by a judicious selection of symbols and tints a large amount of information is given concerning roads, paths, watercourses, lakes, forests, and other matter. No soundings are given round the coast, nor are the depths of rivers indicated in any manner.

AMERICA.

California. **Erdmann.**

Saltonsee, Californien, Oktober, 1906. Von H. Erdmann. Scale 1 : 1,200,000 or 1 inch to 18·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 4. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

Canada. **Department of Militia and Defence, Ottawa.**

Topographic map of Canada. Scale 1 : 63,360 or 1 inch to a stat. mile. Ontario. Sheets 1 N.E. and 1 N.W., Guelph; 3, Niagara. London: Topographical Section, General Staff, War Office. Ottawa: Intelligence Branch, Department of Militia and Defence, 1906. *Presented by the Department of Militia and Defence, Ottawa.*

These are the first sheets of topographical maps of Canada which are now in course of preparation by the Surveys Division of the Department of Militia and Defence; they promise to fill a long-felt need, not only from a military point of view, but as supplying a good general map of the country. When an Intelligence Branch, under imperial officers, was organized in the above department, the want of any topographical map of the country was at once noted as a serious defect, and steps were promptly taken to secure the necessary surveys on which such maps could be based. The work was begun by Major-General Lake sending out, during the summer holidays, survey parties of cadets from the Royal Military College under the imperial officer on duty at the College, but it was afterwards found more satisfactory to transfer the surveying to a permanent staff, General Lake being assisted in the work by Captain A. Clyde Caldwell, R.C.E., Assistant-Director of Intelligence, and Captain W. B. Anderson, R.C.E., Assistant-Director of Surveys.

Elaborate and exact trigonometrical surveys take a long time to execute and are very costly, so rather than delay the matter, as the object was to produce, as rapidly as possible, reasonably reliable military maps, a more expeditious system of surveying was decided upon, giving a resulting accuracy sufficient for the purpose. This consisted in running a series of theodolite traverses some 15 miles apart, and adjusted upon triangulation points of the U.S. Lake Survey and the U.S. Coast and Geodetic Survey. To these traverses the topographical detail has been adjusted, the latter being in the first place filled in by prismatic compass, but now entirely by plane-table surveys, on the scale of 2 inches to a mile. The contours, which on the sheets are at 25-feet intervals, depend upon lines of spirit-levels run about 5 miles apart and referred to the datum of the U.S. Coast and Geodetic Survey. These are supplemented by levels run with Abney levels and aneroid readings. As a check upon the foundation work of

the map, and to ensure greater accuracy, a topographic triangulation has recently been commenced.

Since 1904 a sum of about $20,000 has been expended annually on the work, and about 6200 square miles of topography have been completed, including the Niagara peninsula, from Hamilton to Port Dover, with the greater portion of Eastern Ontario, a triangle with Ottawa, Gananoque, and Cornwall at its extremities. This triangle is now being extended to embrace another triangle having its apex at Montreal. The sheets, which are on the polyconic projection, are now creditably produced and printed in colours—water, blue; contours, brown; wooded land, green. Very complete information is given, by a careful selection of symbols, concerning means of communication, important buildings, and many other matters. Each sheet measures 25 × 18 inches.

It is sincerely to be hoped that they will be issued regularly, and as rapidly as possible.

South America. **Jannasch.**

Spezialkarte von Santa Catharina, Rio Grande do Sul, und Uruguay. Nach den neuesten quellen bearbeitet, herausgegeben von Dr. R. Jannasch. Ausgabe 1907. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Berlin: Leopold Kraatz, 1907.

A general map of Brazil, south of lat. 26° S., including also the Republic of Uruguay and the adjacent parts of Argentina and Paraguay. It is well drawn and artistically printed in colours, but as a great deal of the cartographical material from which the map has been compiled is necessarily of an extremely approximate and sketchy nature, too much reliance must not be placed upon information concerning the interior districts, where, except in the immediate neighbourhood of railway lines and certain special districts, no exact surveys exist. The location of minerals is indicated, and the German and Italian colonies distinguished by different symbols.

South America. **Lange.**

Map of the River Pilcomayo from parallel 22° S. to the River Paraguay. By Gunnar Lange, M.AM.SOC.C.E. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. 7 sheets. Buenos Aires, 1906. *Presented by the Author.*

The map will be specially noticed.

GENERAL.

German Colonies. **Kolonial-Wirtschaftliche Komitee.**

Wirtschafts-Atlas der deutschen Kolonien. Herausgegeben von dem Kolonial-Wirtschaftlichen Komitee E. V. wirtschaftlichen Ausschuss der deutschen Kolonialgesellschaft. Berlin, [1907].

An atlas of the German colonial possessions, showing, by various symbols and colours, the distribution of vegetable products, location of minerals, railways, steamship lines, telegraphs, and other information connected with commercial geography. There are altogether ten sheets of maps, seven of which are devoted to Africa. The maps are preceded by ten pages of letterpress, including an account of the work of the Kolonial-Wirtschaftlichen Komitee, 1896–1906, and tables of exports and imports.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams and 105,000 references. Part 9. London: The Amalgamated Press, Limited, 1907. *Price 7d. each part.*

This part contains the following maps: 115–116, North-West India; 145–146, South Africa (Industries and Communications); 169–170, North-East United States.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas verkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 39, 40, 41, and 42. Gotha: Justus Perthes, 1907. *Price 60 pf. each part.*

The following are the contents of these parts:—Lieferung 39 and 40 (in one). Bl. 35, Pyrenäische Halbinsel in 4 Blättern, Bl. 4; 83, West Canada; 93, West Indien; 96, Süd Amerika, in 6 Blättern, Bl. 2.—Lieferung, 41 and 42 (in one). Bl. 29, Frankreich, in 4 Blättern, Bl. 3; 53, Balkan Halbinsel in 4 Blättern, Bl. 3; 70, Afrika in 7 Blättern, Bl. 2, Ost Sahara. In addition to these maps, the last part contains a continuation of the Index to place-names.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during January, 1907. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.	Inches.	
3643 m	= 10·5	Ports in the Shetland islands:—Balta harbour. 2*s*.
3600 m	= {1·9, 3·9, 5·9}	Japan. Anchorages in Yezo island:—Yesashi anchorage, Abashari anchorage, Nemoro anchorage 2*s*.

New Plans and Plans added.

No.	Inches.	
1381 m	= 1·28	Africa, north coast, Bizerta lakes. Plan added:—Lake Bizerta. 2*s*.

Charts Cancelled.

No.		Cancelled by	No.
991	Anchorages on the coasts of Yezo island. Plan of Nemoro anchorage on this sheet.	Plan of Nemoro anchorage on new chart .	3600

Charts that have received Important Corrections.

Index charts:—A to V. No. 2151, River Thames:—Broadness to Mucking light. 2298, Gulf of Bothnia (sheet 3):—Nystad light to Stor fiord. 2300, Gulf of Bothnia (sheet 5):—Stiernö point to Fiärderäg. 1073, France, north coast:—Dieppe. 909, North American lakes:—Mildrum point to St. Joseph island. 378, Plans in the Gulf of Mexico. 2458, Alaska:—Port Simpson to Cross sound. 3569, Alaska:—Port Valdez. 643, Africa, south coast:—Port Natal. 1000, Siam:—Pulo Condore group. 1342, Cochin China:—Fan Rang bay to Tongking gulf. 1602, China, east coast:—Approaches to the Yang-tse-kiang. 3585, China, east coast:—Approaches to the Wusung river. 3274, Yang-tse-kiang:—Tung Ting lake and Siang river. 1256, China, north coast:—Gulfs of Pe Chili and Liau Tung. 2405, Russian Tartary:—Kuril islands to Kamchatka. 691, Australia, east coast:—Normandy sound and Prince of Wales channel.

(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat. and Red Sea for March, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for March, 1907. London: Meteorological Office, 1907. *Price 6d. each. Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for February, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for March, 1907. Washington: U.S. Hydrographic Office, 1907. *Presented by the U.S. Hydrographic Office.*

Norway. **Norges Geographiske Opmaaling.**

Specialkarte over den norske kyst. Scale 1 : 25,000 or 2·5 inches to a stat. mile. Sheets C 1, 2, and 3. Specialkarte over den norske kyst. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets B 45′, 50, 53, 65, 66, 68. Specialkarte over Havne i Finmarken. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheet ii. Christiania: Norges Geografiske Opmaaling, 1907. *Presented by the Norwegian Geographical Institute.*

PHOTOGRAPHS.

Mongolia. **Hedley.**

One hundred and fifteen photographs of Inner Mongolia or Outer Chih-li, taken by the Rev. John Hedley. *Presented by the Rev. John Hedley.*

These photographs were taken during an interesting journey made last year by

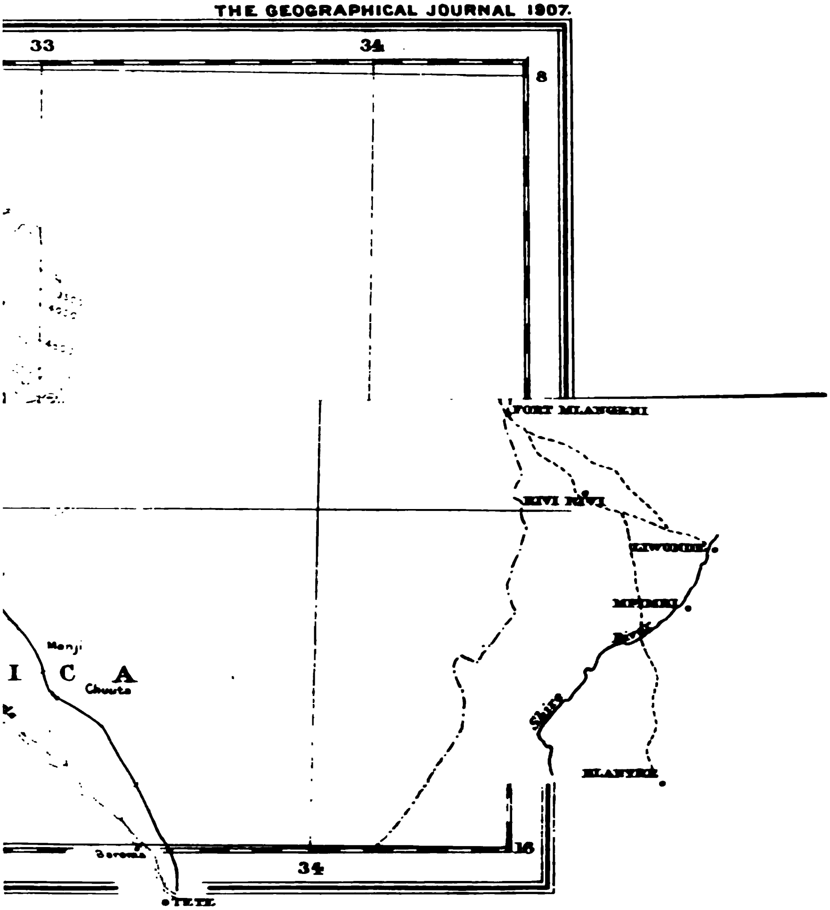
Mr. Hedley, and concerning which a short account, with a sketch-map, will shortly appear in the *Geographical Journal*. Although small, many of them are remarkably clear. The following are the titles:—

(1) My five assistants on trip; (2) Temple at Yung-p'ing Fu, alongside mission compound; (3) East wall at Yung-p'ing Fu; (4) Outside east gate at Yung-p'ing Fu; (5) North gate at Yung-p'ing Fu; (6) Village of Lêng-k'ou-kuan, showing Great Wall; (7 and 8) Great Wall at Lêng-k'ou-kuan; (9) Custom-house at Lêng-k'ou-kuan, with section of Great Wall; (11) Section of Great Wall outside Lêng-k'ou-kuan; (12) Our company passing through Ta-chang-tzŭ; (13) Manchu women and children at T'u-shih-mên; (14) Temple to god of war at Lo-t'o-ling; (15) Our animals in Chinese inn yard; (16) Our plane-table on top of Pa-huo-chih-ling; (17) Pack-mules ascending Pa-huo-chih-ling; (18) A rough road near the T'u-shan; (19) Chinese hut on top of pass near T'u-shan; (20) Village of Ch'ê-ch'ang-kou, taken from pass; (21) The Ch'ing-lung Ho, 70 miles north of Yung-p'ing Fu; (22) A rest by the way; (23) Yü-lin-shan on the Ch'ing-lung Ho; (24) Pastoral scene *en route* to T'a-tzŭ-kou; (25) Lama priest with stocking of Emperor K'ang-hsi; (26) Confucian temple in new schools at T'a-tzŭ-kou; (27) Temple to god of war at T'a-tzŭ-kou; (28) Kuei-hsing-lou at T'a-tzŭ-kou; (29) Temple to god of wealth at T'a-tzŭ-kou; (30) Mineral water springs at Je-shui-t'ang; (31) Mahommedan inn at Mang-niu-ying-tzu; (32) Pack-mules carrying skins near Ta-ming-ch'eng; (33 and 34) The Famous Pagoda at Ta-ming-ch'eng; (35) Shih-san-t'ai-pao, near Ta-ming-ch'eng; (36) Mongol women at Ta-ming-ch'eng; (37) Types of Mongol faces; (38) Mongols worshipping at the Famous Pagoda; (39) Inn yard at Mei-li Ho near Hata; (40) Village of Ma-chia-tzŭ, near Hata; (41) Official at Hata with foreign visitors; (42) Foreign visitors at Hata; (43) Chinese official at Hata with bodyguard; (44 and 52) Street scene at Hata; (45) Showing rooms prepared for Prince Su, Hata; (46) Street scene, Hata, with cartwright's stock-in-trade piled up; (47) Residence of Mongol Prince of Wêng-niu-t'e at Hata; (48) Second brother of Prince of Wêng-niu-t'e; (49) Third brother of Prince of Wêng-niu-t'e; (50) Son and heir of Prince of Wêng-niu-t'e; (51) Lama abbot of princely rank; (53 and 54) Fording the Shih-la-ka Ho, 5 miles from Hata; (55) Native coal-mine at Yuan-pao-shan; (56) Lao Ho near Shan-tsui-tzŭ; (57) Mongols watering animals at Old Palace on Lao Ho; (58 and 59) Ruined house of murderer of Ao-han prince, Old Palace; (60) Whisky distillery at Yü-t'ien-kao owned by lama prince; (61) Mongol hut at Yü-t'ien-kao, Lao Ho; (62) Mongol Tama Laoyeh at Hsiang-shui, Lao Ho; (63–66) Views of waterfall at Hsiang-shui; (67) Pastoral scene at Hsiang-shui; (68) In the sand deserts beyond Hsiang-shui; (69) Village of Cha-kan-tao-hai; (70) Lama temple in the grass-land, Lao Ho; (71) Tomb of lama abbot; (72–76) Mongol camels on the march; (77) Steward of Mongol prince, with imperial cart; (78) Arm of the Lao Ho, 5 miles from Shira-muren; (79) Lao Ho, 2 miles from Shira-muren, looking north-east; (80) Lao Ho, 2 miles from Shira-muren, looking south-west; (81 and 82) Dry bed of Shira-muren at confluence with Lao Ho; (83) Old Chinese "Neptune" at Shira-muren; (84) Servant viewing his spoiled garments after upset in Lao Ho; (85) Pastoral scene in grass-land; (86) Lunch in the sand-desert; (87) Moving a Mongol tent in the grass-land; (88) Manure heaped up for fuel in grass-land; (89) Mongol women 82 years old, with shaven head, and Mongol guide; (90) A lama guide on the grass-land; (91) House of wealthy Mongol in the sand-desert; (92) In the sand-desert, near Yang-shu-mu; (93) The Shih-pei Ho at village of that name; (94 and 95) Main street of K'u-lu-kou; (96) Tibetan lama prince at K'u-lu-kou; (97) Favourite riding-horse of Tibetan lama prince; (98) Private apartments of Tibetan lama prince; (99) Lama temple in monastery at K'u-lu-kou; (100) Marisami, the Indian surveyor, having his head shaved at K'u-lu-kou; (101) Mongols loading up their camels at K'u-lu-kou; (102) Mongol feeding camels in inn yard; (103) Wayside lama temple at Pei Tzu Fu; (104 and 105) Lama temple near Chao-yang Fu; (106) Old lama priest, 82 years old; (107) Village near Chao-yang Fu; (108 and 109) Distant view of pagoda in Ch'ao-yang Fu; (110) Street scene in Chao-yang Fu; (111) Pagoda in Chao-yang Fu; (112) Roof of lama temple, Chao-yang Fu; (113) Lama temple in Chao-yang Fu; (114) Ferry on Ta-ling Ho, at Chang-pao-ying-tzŭ; (115) Fording the Hsiao-ling Ho.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

N.E. RHODESIA.

WALLACE.



The

Geographical Journal.

No. 5. MAY, 1907. Vol. XXIX.

TO THE NORTH MAGNETIC POLE AND THROUGH THE NORTH-WEST PASSAGE.*

By Captain ROALD AMUNDSEN.

To Sir John Franklin must be given the honour of having discovered the North-West Passage, and to Admiral Sir Robert McClure that of being the first to pass through it, partly in his vessel the *Investigator* and partly on foot. On the foundations laid by the splendid work done and the rich fund of experience gained by English navigators in these regions, I succeeded—in the track of Sir James Ross, Dr. John Rae, Admiral Sir Leopold M'Clintock, Sir Allen Young, and many others—in making my way in the *Gjöa* to the region around the Earth's north magnetic pole, and, furthermore, in sailing through the North-West Passage in its entirety. If I have thus been the first to sail through the North-West Passage, it is with pleasure that I share the honour with those brave English seamen—the seamen who here, as in most of the other parts of the world, have taken the lead and shown us the way.

It was the Norwegian minister to England, Dr. Fridtjof Nansen, who, by his great experience and his many good counsels, made the *Gjöa* Expedition what it was: one in all respects well planned and excellently equipped. In order not to tire my hearers, I will give in as few words as possible the earlier history of the expedition.

The scheme of the *Gjöa* Expedition I had a welcome opportunity of laying before the Norwegian Geographical Society on November 25, 1901. It was briefly as follows: With a small vessel and a few companions, to penetrate into the regions around the Earth's north magnetic pole,

* Read at the Royal Geographical Society, February 11, 1907. Map, p. 596.

and by a series of accurate observations, extending over a period of two years, to relocate the pole observed by Sir James Ross in 1831, and also to make investigations in its immediate vicinity. This was the chief object of the expedition.

The condition of the ice still farther west allowing of it, it was furthermore my intention to attempt to sail through the North-West Passage in its entire extent, this being a problem which for centuries had defied the most persistent efforts. I chose a small vessel, with the view to be better able to pass through the sounds of these regions, which are narrow, shallow, and generally packed with ice. In preferring a small number of members to a larger one, it was—apart from want of space—because, in the event of such a misfortune occurring to us as the loss of our vessel, it would be easier to find means of subsistence for a small than for a greater number of men.

My undertaking, as soon as it became known, awakened great interest in very wide circles, and several wealthy men came forward and supported the enterprise with donations. It would take too long to name all the persons who gave the expedition pecuniary support, but I must in respectful gratitude mention the names of their Majesties King Haakon and King Oscar II.

The vessel of the *Gjöa* Expedition was built in Hardanger in 1872, and was my only contemporary on the trip. She had originally been used in the herring fisheries along the Norwegian coast; later she was sold to Tromsö, whence she sailed for many years in the Arctic sealing trade. She had weathered many a storm, though not always scathless. After my purchase of her, I had a small petroleum motor, of 39 indicated horse-power, put into her, to help us along in calm weather. The ice-sheathing, which before only reached a couple of planks under the water-line, I had lengthened right down to the keel; stout cross-beams were put into the hold and connected with massive joints to the deck and keelson, and the old hempen rigging was replaced by wire rigging.

I had chosen my companions by degrees. First in order I must mention the man who sacrificed his life in the service of the expedition, Gustav Juel Wiik. He was born in 1878, at Horten, and thus lived to be somewhat over twenty-seven years of age. From six weeks' study shortly before the departure of the expedition, at the Magnetic Observatory at Potsdam, where he particularly studied the use of self-registering magnetic instruments, he returned with the most excellent testimonials for industry and thoroughness. I had a good opportunity of seeing, during our three years of work together, that these testimonials were not exaggerated, and the magnetic data we brought back with us I owe, in the first instance, to this young man's painstaking and accurate labour. In addition to his position as assistant in the meteorological observations, he was also the second engineer.

The second in command of the expedition was Lieut. Godfred Hansen, of the Danish navy, born in Copenhagen in 1875. His light-hearted disposition was of absolute benefit to us, and during the three years—more than three years—that he and I spent together in the little cabin of the *Gjöa*, 6 × 9 feet, I became more and more attached to him. It was prophesied before our departure from Norway, that

CAPTAIN ROALD AMUNDSEN.

within a year we should not be able to bear the sight of one another; this prophecy, however, we thoroughly gave the lie to, and I almost think we could have managed three years more. He was the navigator of the expedition, the astronomer, geologist, surgeon, photographer, electrician, and an expert in dealing with our explosives. He also played star-parts as meteorologist and magnetician. Sergeant Peder Ristvedt was born in Sandsvär in 1873. Besides being first engineer,

he was also our meteorologist, smith, clockmaker, copper and tinsmith, gunsmith, etc. I knew Ristvedt before I engaged him, as he had taken part as assistant in my first expedition in the *Gjöa* in 1901. I was thus aware of what I was doing when I secured the service of this capable man and pleasant companion. Anton Lund was the first mate of the expedition. He was born at Tromsö in 1864, and was thus the oldest member of the expedition. He had sailed from his earliest youth on our Norwegian sloops to the Arctic ocean, and was consequently an unusually experienced man in all matters connected with the condition of the ice and navigation through it. Helmer Hansen was born in the Vesteraal islands in 1870. He had previously been a peasant, fisherman, and Arctic navigator. His position was that of second mate, and he was careful and conscientious in all that he did. Last of all, then, comes the cook, Adolf Henrik Lindström, born at Hammerfest in 1865. He took part in Sverdrup's expedition in the *Fram*, and had thus extensive experience as an Arctic cook. I will confine myself to informing you that, besides providing us for three years with excellently prepared food, served to the minute, he voluntarily filled the vacant posts of botanist and zoologist. His kitchen work ended, he was pretty sure to be seen abroad on arctic summer evenings with his botanical collecting-box, his shotgun, and his butterfly-net, and woe to the flower, bird, or insect which came his way! After this description of my comrades, I feel sure that none of my hearers will be surprised that we succeeded in accomplishing what we did.

At twelve o'clock on the night between June 16 and 17, 1903, we cast off, and the *Gjöa* was towed down the Christiania fjord. It poured with rain, and was as dark as in a sack. Some of my friends tried to console me by saying that the weather was much the same when Nansen started in 1893, and that it was a good omen. However, I had never been a believer in omens, and I therefore felt myself, in spite of these auspicious torrents, very uncomfortable in my soaking clothes. At six in the morning we entered the harbour at Horten, where we took our explosives aboard. At eleven in the forenoon the last tie which bound us to home was broken, for the tow-rope snapped, and left the *Gjöa* to her own fate. We were then just outside Färder lighthouse. After the tug had given us the proper farewell civilities, it stood up the fjord again, and the *Gjöa*, by her own exertions, worked her way slowly forwards against a southerly breeze. The voyage across the Atlantic has been made countless times, and does not offer any particular interest. A great number of people had, indeed, designed this ocean as the *Gjöa's* last resting-place; but, in spite of many prophecies and many warnings, our good little *Gjöa* quietly and calmly worked her way onwards, giving not a moment's thought to all the wiseacres. How glorious it was to have exchanged the narrow hot streets for the open sea! and not only we human beings enjoyed the change, but our dogs likewise. We had,

I should explain, six dogs with us which had taken part in Sverdrup's expedition, and they seemed to enjoy the voyage exceedingly, running about and getting into as much mischief as was to be attained. Their spirits were particularly high on rough days, as then they had an agreeable change in their otherwise somewhat monotonous diet (consisting of a stockfish and a quart of water), in the shape of the delicious viands sacrificed to them by my seasick companions.

On July 9 we sighted the first ice, in the vicinity of Cape Farewell, the southern extremity of Greenland, and on the 11th the land round the cape itself appeared in sight. The wind, which had not been particularly favourable to us up to this, did not improve now, and our

GODHAVN.

voyage up the whole of the west coast of Greenland was thus one single struggle against the ever-prevailing north wind. We had to console ourselves with the proverb that "it is an ill wind which blows nobody any good." Though the contrary wind from the north hindered our progress, it at any rate set the ice in motion southwards, and made a way for us.

The voyage, which had hitherto been somewhat monotonous, became more lively on the appearance of the ice. Icebergs of varying shape glided past us and took captive our attention. Now and then we made an excursion into the drift-ice, and shot some of the beautiful large bladder-nose seal that were lying about on the higher parts of the ice. Both men and dogs were longing for fresh meat, and this sealflesh provided us with an agreeable change in our menu.

On July 24 we sighted Disco island, and the day afterwards anchored at Godhavn, whither the Royal Danish Greenland Trading Company had been kind enough to bring some of our equipment in their ships. Here we spent five days, enjoying the great hospitality of the inspector and the governor of the colony. After having taken a series of

magnetic and astronomical observations, and shipped all our things, we left the place on July 31.

On August 8 we reached Holm island, which marks the beginning of the redoubtable Melville bay. The ice was packed close, but, however, proved to be broken. We kept cruising backwards and forwards alongside the edge, watching for an opportunity to enter it, and at last, on the evening of the 10th, it so far slackened that we were able to slip in. In thick fog, we wound our way about through fairly practicable ice, a few icebergs now and then breaking up the dense masses of the fog with the strength of their flashes, calling to us their own warning. On August 13, at half-past two in the morning, we saw the last of this fog, the *Gjöa* quietly and calmly gliding out of the thick masses, which had surrounded us as in a nightmare for several days, into a new world, lighted up by the loveliest sunshine, and with a marvellously beautiful view. In the east we saw the head of Melville bay filled with impenetrable icefields; in the north lay the fine mountain scenery around Cape York, beckoning and calling to us in the sunshine—the feeling was overwhelming; before us, shining in blue and white, lay the huge masses of drift-ice. There was not much open water to be seen from the masthead, but then we did not want very much. On August 15 we reached Dalrymple rock, where two Scotch captains, Milne and Adams, had left a largish depôt for us. Here we fell in with the Danish Literary Greenland Expedition, and spent a few lively and pleasant hours with the members of it. On August 17 we continued our voyage, and bore across Baffin bay, in sight of the Carey islands. It was lucky for us that we met with calm weather here, for with our deeply laden vessel a storm might have had serious consequences. Besides our sky-scraping deck cargo, there were on the top of it all our eighteen dogs, the greater number of which had been shipped at Godhavn. By way of making the time go quicker, they had divided themselves into two about equally strong sides, and from time to time made inroads on each other's territory. This game, needless to say, was hardly to the liking of the man who happened to have the watch, and many a round oath found its way out into the world. On August 20 we stood into Lancaster sound; a few icebergs, which had collected round Cape Horsburgh, and some slack ice stretched straight across the sound. We kept in under the northern shore. The land made an exceedingly barren impression; there was no vegetation to be seen, and the mountains were high and table-topped. It was, however, not often that we were able to see land, the fog for the most part being thick and heavy.

On August 22 we reached Beechey island, where I had arranged to stop and take a series of magnetic observations, which were to decide our future course. Before the departure of the expedition, several persons more interested than learned in terrestrial magnetism had

written to me, pretending by a subtle method, which, however, they did not disclose, to have discovered that the magnetic pole had moved, with a speed of I don't know how many miles in the year, in a north-westerly direction, and was now on Prince Patrick's Land. They might as well have said in the moon for all they knew.

Beechey island gives a barren and dismal impression; and particularly sad are the ruins of the house erected by the British Government for the succour of the Franklin Expedition. Five graves did not make it any more cheerful. The memorial stone to Sir John Franklin was the only thing which in the least brightened all this sadness—a handsome marble tablet, put up to his memory by his faithful wife.

The magnetic observations indicated the pole as being in a southerly

ESKIMO CAMP NEAR GJÖA HARBOUR.

direction, and Prince Patrick Land was this time left in peace. We left Beechey island on the 24th, and shaped the course for Peel sound, entering those waters in dense fog. The ice was the whole time fairly practicable, and we met only loose streams which presented no hindrance. At Prescot island the compass, which for some time had been somewhat sluggish, entirely refused to act, and we could as well have used a stick to steer by. Navigation, as we now practised it, was at first a somewhat unfamiliar proceeding, and when one watch released the other, and the fog lay close and compact, as it always did, strange remarks might have been heard. "What are you steering?" would ask the relieving watch, in a cross and sleepy tone. "Supposed to be steering south, but ain't sure we're not going north;" and as he handed the tiller to the other, one would hear, "Steady—so." So there one would be

at two o'clock in the morning, just up from a comfortable warm berth, the fog pouring down over everything, and absolutely nothing to be seen in any direction, and one was to steer steady! This was certainly great fun; but custom is a remarkable thing. Within a short time we became quite at home even with this sort of navigation, and we made way. On August 28 we passed the spot where Sir Allen Young was stopped in his vessel the *Pandora* by impenetrable ice. Later in the forenoon the western entrance to Bellot strait, where Sir Leopold M'Clintock in vain tried to get through, was passed. Now began our voyage along the west coast of Boothia Felix—a voyage that more than once looked dark for us. We were not hindered by ice to any great extent; the land lead was, as a rule, so wide that we could get along without difficulty; but that which was worse for us was the shoal water, the constant fog, and the pitch-dark nights. On August 31 we struck ground for the first time. The weather, however, was fine, and we got off without injury. In the evening we anchored off a low island to wait for daybreak, for I no longer dared to go on now that the nights were so dark, and in such foul waters. How peaceful everything was that evening! It was an unusually dark night and absolutely calm, and what greatly increased our already romantic position was the fact that we—I confess it openly and without shame—had no idea where we were! The land had been mapped in winter, and many of the small islands which we came across were not marked at all, the snow covering them at the time having rendered them invisible. All was so peaceful, quiet, and calm. We had all retired, and left the watch to one of the engineers whose turn it happened to be. I had just got out my log to enter the events of the day, when I was suddenly interrupted by the cry of fire. I knew what this meant on board a small vessel carrying 7000 gallons of petroleum, great quantities of gunpowder and explosives, and whose whole hull was, besides, saturated with tar. We were all up on deck in less time than it takes to tell it. The first thing that met our eyes was an enormous pillar of fire rising up through the engine-room skylight. Things didn't look peaceful any longer. We all ran like mad for vessel and life! The engineer on watch had not left his post; he was holding out bravely down below in the suffocating smoke, trying to the best of his abilities to subdue the fire, which had arisen in some cotton permeated with petroleum. This was Wiik. We succeeded by united exertions in becoming master of the fire, and got off without much damage.

The evening of this same day we beat up under an islet and anchored there. We took this to be one of the small islands lying north of Malty island. It was then blowing hard and night coming on. At four the next morning we weighed, and continued our course. It was a fine morning, partially clear, and with a westerly breeze. I was at the tiller, and my two comrades were hoisting the sails. Suddenly there was

a shock, and we struck three times. All expedients to get off were in vain, and there we were for thirty hours. A strong breeze blew up from the north, and came to our assistance, and under crowded sail we succeeded in forcing the *Gjöa* across a 200-yard-long bank, and out into comparatively deep water. We only lost our false keel; but from that day to this it has been a matter of wonder to me that human handiwork could have withstood the treatment which the *Gjöa* underwent on that occasion. During this enforced delay we got a determination for position, and thus knew where we were. About midday we cast anchor off Cape Christian Frederik, on Boothia Felix, so as to get things a little in order after grounding. The wind was then slack and off shore. At eleven in the evening, it suddenly went over to the

VEGETATION AT KING POINT.

south-east, and blew hard. There was no question, in the darkness and the shoal and foul sea outside, of getting under way. There was only one thing to be done, and that was to pay out our cables to the bitter end and await results. The wind soon increased to a gale, the seas were high and short, shaking our chain cables violently. The land did not look as well now as when we came in and anchored into it to leeward. All hands were on deck, and getting ready for the stranding which seemed inevitable. Each man had had his work allotted to him, and at the moment when the cables gave would be in readiness at his post. The petroleum motor was going at full speed, and the vessel was kept well up to the wind and sea, by which means I hoped to ease a little the violent strain on the cables. We had anchored at midday on the 3rd, and it was not till four o'clock on the 8th that the wind dropped sufficiently for us to get out again. Then another drifting night in pitch

darkness among shoals and rocks, and then at last release. It is impossible to describe the well-being, the feeling of calm and safety, which came over us after these ten days of ceaseless fighting, when we dropped anchor on September 9, at half-past three in the afternoon, at the head of Petersen bay, in King William Land. There, approached by a narrow inlet, lay the harbour which was to be our place of sojourn for two years—"Gjöahavn," or Gjöa harbour. A fresh land breeze prevented us from standing in, and it was not till the evening of the 12th that it fell sufficiently for us to beat up against it and drop anchor. Now we could breathe. We had done a good bit of work.

"Gjöahavn" was all that the heart could desire, small and landlocked. Low sandy land, covered with moss, rose gently upwards from all sides, until it reached a height of 150 feet, and thus formed a sheltered little basin where we could lie safe and snug. The day after our arrival here I rowed ashore with my instruments to ascertain the state of the magnetism in this area, and, strange as it may sound, we had found the very spot which, according to my scheme, was the most suitable for a magnetic station—about a hundred nautical miles from the magnetic polar area. There was no longer any doubt; this would be our home for the next two years. The time after this was very busy. The vessel was hauled close up to the shore, which fell abruptly away, a conveying rope rigged to the masthead, and all our provisions passed ashore by means of it. Everything was put in order, and the house which we built covered over with a sail.

Then came the observatories, and of them a mushroom growth sprang up. First the magnetic variation house, then a dwelling-house for the meteorologist and magnetician, the two latter being built of empty provision cases filled with sand. After that came the house for the absolute magnetic observations: the walls were built of blocks of snow, and the roof made out of thin transparent sailcloth. Finally, we built the astronomical observatory, which was known as "Uranienborg," this also being of snow, with a sailcloth roof. Besides all this building, we had done another good stroke of work in the shape of killing a hundred reindeer, and we had thus abundant provisions for ourselves and our dogs throughout the winter. The ice formed on October 1 and 2. The vessel was then covered with a winter awning, and everything got ready to receive the approaching winter.

On October 29 the first Eskimo made their appearance. Expectation on this point had always run high, and we had talked daily about meeting with them. Sir John Ross, in his description of his voyage, gives the word "Teima" as the usual salutation between white man and Eskimo; and we had therefore carefully laid this word to heart in order at once to check any warlike desires, should they be apparent. This first meeting was exceedingly ridiculous, and is one of our liveliest reminiscences. With two companions, armed to the teeth—namely,

Anton Lund and Helmer Hansen—I started off to meet the Eskimo, walking first myself, with two comrades following me at about three paces' distance. They had shouldered their guns, and had such a fierce expression on their faces that it alone would have been enough to put a warlike detachment to flight, to say nothing of the five unfortunate Eskimo who were approaching us. The step and set-up of my detachment were unexceptionable. Arrived at about a hundred paces from us, the Eskimo stopped, and we, not wishing to show less strategic ability, did likewise. Now, I thought, is the moment to set this matter at rest, and shouted "Teima" at the top of my voice. It did not seem to affect them in the least, and, after a short parley among themselves, they recommenced their march on us. They were five in number, had formed in a sort of fighting line, and now advanced towards us smiling and humming. Two of them had their bows firmly secured to their backs, and the three others were apparently unarmed. We on our side, of course, reassumed our advance, repeatedly shouting, "Teima, teima," and the Eskimo answered, but with quite another word, namely, "Manik-tu-mi." We now approached one another quickly, and finally ended by meeting. It was a remarkable encounter. The Eskimo stroked and patted us both in front and behind, all shouting "Manik-tu-mi" as hard as they could. We, true to our original plan of campaign, copied our adversaries, and shouted and howled, patted and slapped, to the best of our ability.

They were fine men, these Eskimo, tall and strongly built, and in their appearance reminded me more of Indians than of Eskimo, having the redskin type of complexion; they were, moreover, slim, and, as I said before, tall. The ordinary broad and fleshy Eskimo nose was exchanged for one better in shape, somewhat hooked; their hair was cut short, with the exception of a small crest of long hair which stretched from one temple round the nape of the neck to the other temple. We now proceeded, laughing the whole time, to the vessel. These Eskimo called themselves "Ogluli Eskimo," and looked upon the North American coast from Back river westwards to Adelaide peninsula as their hunting-fields. We made many good friends among this race, but it was not till later, when we met with the "Nechjilli Eskimo," that we made inseparable allies.

On November 2 the permanent station began its work. I will try, in as few words as possible, to explain terrestrial magnetism and the use of our magnetic instruments.

Terrestrial magnetic power is, with regard to direction and force, different on every point of the surface of the Earth, nor is it always the same in one and the same place. It is subject to regular daily and yearly changes, and, similarly, there often occur irregular more or less violent disturbances. Finally, small displacements show themselves from year to year, which continue in the same manner for a long series

of years. All this has been discovered through observations undertaken during the course of time at various parts of the surface of the globe, partly during travels, and partly by permanent stations. A careful study of all the available material which had been acquired by observation caused the great German mathematician and physicist, Gauss, in the thirties of last century, to form a theory as to the sequence and varied appearance of the phenomena of terrestrial magnetism at a certain moment of time according to the geographical latitude and longitude. It thus became possible to construct three different maps, of which two show the direction of the force, and the third its strength. The reason why two maps are necessary for direction is because the direction must be given both in relation to the north and to the south geographical line, and in proportion to the horizontal plane of a place. The direction of the terrestrial magnetic force in relation to the north-to-south line can be observed by the help of the compass, which, as we know, generally points somewhat east or west of this same north. This divergence is called the variation or the declination. On a magnetic map lines are drawn which show the direction of the magnetic needle at every point of the Earth's surface. These lines, which are called magnetic meridians, converge at two points—the north magnetic pole, on the Arctic coast of North America, and the south magnetic pole, in the interior of the Antarctic continent. Each of the lines indicates, as will be understood, the direction one would go if he followed exactly the direction indicated by the north or south end of the magnetic needle. In the first case, one would at length arrive at the north magnetic pole; in the other, at the south magnetic pole.

If a magnetic needle be placed so that it can turn on an axis through its centre of gravity—exactly like a grindstone—the needle will of itself adopt a diagonal position when the plane of revolution is identical with the direction which the needle of a compass indicates. An instrument of the kind is called an "inclitorium," and the angle which the dipping-needle forms with the horizontal plane is called the magnetic inclination of a place. Here, in our parts, the north end of the needle points down towards the earth; in Australia, on the contrary, it is the southern end which dips. At the north magnetic pole the dipping-needle assumes a vertical position with its north end down; at the south magnetic pole it assumes a vertical position with its south end down. The inclination, then, at both their points is 90°, and decreases according as the distance becomes greater from them. On a series of points within the tropical zone the inclination is 0°; that is to say, the dipping-needle places itself exactly horizontally, and that line which we may imagine as drawn through all these points is called the "magnetic equator." It is situated partly above, partly beneath, the Earth's geographical equator.

The force of terrestrial magnetism works, as will be understood,

with its whole strength in the direction given by the dipping-needle, and it may be asked, How great is this force in the different places? In order to discover this we must imagine the force dissolved into two parts, one part working horizontally, and one part working vertically. It is evident that it is the horizontal part of the force which causes the needle to take a set position, and if we know all about this force—"horizontal intensity," as it is called—and at the same time know the inclination, it is easy, by a simple calculation, to find the collective strength, the total intensity. For the determination of horizontal intensity two methods are adopted, either each one alone or preferably, for the sake of comparison, simultaneously. One method consists in

DRIFTWOOD AT KING POINT.

placing a magnetic bar by the side of a needle at a given distance from it, and observing how many degrees the needle moves away from its original position. It is clear that the weaker the horizontal intensity the greater the oscillation of the needle, and when the strength of the magnetic bar is known, it is possible, by the aid of the angle of oscillation and the distance, to calculate the horizontal intensity.

The other method is to note the time of oscillation of a magnetic bar suspended by a thread in such a manner that it can revolve in the horizontal plane. When the magnet is allowed to be at rest, it sets, under the influence of horizontal intensity, in the direction of the needle. Brought out of equilibrium by a little push, it will swing backwards and

forwards, and the stronger the horizontal intensity, the sooner it will come to rest again, or, in other words, the shorter will be the time of each individual oscillation. When the strength of the oscillatory magnet is known, and observation is made of how many seconds are necessary for an oscillation, the horizontal intensity can be calculated.

Maps are constructed to give an idea of the value of horizontal intensity, expressed in so-called electric units, on the different parts of the Earth. A line passes through all the places where the horizontal intensity is the same. The horizontal intensity decreases towards the magnetic poles. It is, therefore, matter of consequence that terrestrial magnetism here, where the inclination is 90°, acts with its whole strength vertically downwards, and thus cannot have any effect in a horizontal direction.

Although the magnetic maps are very dissimilar, they are alike in one respect, namely, that the magnetic poles are the points of mark on the surface of the Earth, and it is obvious that magnetic investigations just at these points, or in their immediate vicinity, must be of the greatest interest to the science of terrestrial magnetism. The Gauss theory by no means solves all the riddles presented by the phenomena of terrestrial magnetism, but continual efforts are being made to complete these riddles by the collection of as reliable and comprehensive observations as it is possible to procure.

The magnetic work of the *Gjöa* expedition is intended to be a contribution to this object. But the difficulties were not small. The very fact that horizontal intensity, as we have heard, becomes, in the vicinity of the magnetic poles, so infinitesimally small, renders necessary extraordinary precautions for the determination of this itself, as well as of the variation. The *Gjöa* expedition's equipment of instruments was calculated for this purpose. The magnets, fourteen in number, were chosen with great care in Potsdam just before our departure. The inclination we were able to determine by the help of three inclinatoria of varying construction, and for the determination of the declination we had two different instruments.

Added to these were a set of self-registering variation apparatus; that is to say, three instruments permanently erected in a dark room, each instrument containing a small magnetic needle, two of the latter being suspended by a fine quartz thread, the third oscillating on a fine bearing in such a manner that the needle with its movements followed the declination, the second the horizontal intensity, and the third the inclination, even its minutest changes. Each needle was provided with a looking-glass, which reflected the light from a lamp on to a drum covered with photographic paper, which, by means of clockwork, made one revolution during the course of the twenty-four hours. It was arranged so that the reflection from each of the three needles struck the drum at different heights, and caused a little dark spot; but when

the drum with its paper revolved, each of these spots was continued, forming a consecutive dark line. There were thus three dark lines across each other on the paper, when after the lapse of twenty-four hours it was taken off.

After what we have already heard, it will easily be understood that it would not have done to select the pole itself for a permanent observation station, even had we known beforehand its exact situation, and could have foreseen that it would keep immovable on one of the same spor. Advised by Prof. Adolf Schmidt, I therefore decided to make the base station, where the instruments for variation were to be erected, at such a distance from the pole that the inclination would be about 89°. This

ESKIMO CAMP AT KING POINT.

requirement was fulfilled by Gjöahavn, which accordingly became our headquarters. We constantly made excursions hence to adjacent parts of the country, and right in to Boothia Felix, where I succeeded by the help of declination in absolutely proving what of late has been assumed on theoretic grounds, namely, that the magnetic pole has not an immovable and stationary situation, but, in all probability, is in continual movement. In what manner this movement takes place our considerable amount of material acquired by observation will, when it has been worked out, give instructive information.

The magnetic observations were kept going day and night, without interruption, for nineteen months. Meteorological observations were also taken the whole of the time. Prof. Mohn had equipped the expedition with a complete set of meteorological instruments, and made it his business that the meteorologist of the expedition should receive the best

instruction. The meteorologist, Dr. Aksel Steen, was my magnetic counsellor at home in Norway, before the departure of the expedition, and many a good bit of advice did he give me. The astronomical equipment was for the greater part due to Prof. Geelmuyden.

The Eskimo came and went now as often as they liked, and in a short time became quite at home with us. Towards Christmas they all disappeared, with the exception of an old man, Teraiu, with his wife, Kaijoggolo, and little son, Nutara. They came and lived with us during the whole of the coldest part of the winter, the rest of the tribe having gone westward to capture seal.

Christmas was now approaching with rapid steps, and countless preparations were made. The days had begun to be shorter and the cold sharper. Then came Christmas Eve, the first on board the *Gjöa*. The weather was splendid, absolutely still, and sparklingly bright. The thermometer $-40°$ Fahr. ($-40°$ C.). And what a Christmas Eve it was out here! Was not heaven itself sending us a greeting? The most glorious aurora we had yet seen lighted up the entire sky, in chasing rays from the horizon towards the zenith. The rays seemed to be racing one another, racing to see which would be the first in the wild chase. Then they all suddenly unite, as if at a given signal, and change into the shape of a soft, delicately-formed ribbon, twisting in light and graceful movements. It is as if the unquiet beams had now sought rest. Are they, perhaps, thinking of something new? Then suddenly the beautiful ribbon is, as it were, torn in many pieces. Again begins the chase, again the wild flight. It is difficult to imagine what the next step will be. It seems as if the zenith would now be chosen as the central point for the whole movement. And so it is. Suddenly, as if by magic, the most glorious corona streams forth from it.

Christmas goes, the New Year comes. The many holidays have already begun to tire us, and we take up our work again with pleasure. The first item on our programme is the equipment for my approaching sledge journey to the immediate area of the magnetic pole. The original plan was that I should make this expedition with one companion and provisions for three months, supported by a relieving expedition under Lieut. Hansen with one man. There were consequently four of us who were obliged to have their things in order by a certain date. In one thing there was a general consensus of opinion, namely, that Eskimo fur garments were the most suitable for this climate. We had, therefore, taken time by the forelock and bartered with the Eskimo for the lightest and finest reindeer-skin clothing we could get. After many small trials, too, we all agreed that snow-huts were far superior to tents when the temperature was below $-22°$ Fahr. ($-30°$ C.). I therefore started a class, with old Teraiu—the Eskimo who stayed with us, with his family—as teacher. We all four joined, and now built a snow-hut regularly every forenoon. Sometimes one of us was master

builder and the others masons, sometimes the other. Old Teraiu, who could not understand what we were building all these huts for, shook his head pensively, evidently in the conviction that we had taken leave of our senses. Sometimes he would throw out his arms to indicate the overwhelming number of houses, and exclaim, "Iglu amichjui—amichjui—amichjui!" Which means, "This is a dreadful lot of houses." But in this, too, we arrived at what we wanted: we became at last good snow builders.

INTERIOR OF SNOW-HUT.

On February 29 we took our sledges up on to the heights in order to be ready for a start the next morning. The day for the beginning of our sledge-journey broke clear and still. The temperature was not exactly summery, the thermometer reading nearly $-64°$ Fahr. ($-53°$ C.).

One sledge had a team of seven, mostly young dogs, for we had lost all the others during the course of the winter from one or other mysterious disease: the other sledge was hauled by three men. We found it difficult to make any way; the sledges ran badly. The snow

In the beginning of June, large numbers of Eskimo appeared at the ship with blubber and skins of seals for sale which they had caught during the course of the winter months. We paid them in wood and iron. In the middle of July most of them left us again, to hunt reindeer and catch salmon in different directions. In the summer of 1904, Lieut. Hansen went a rowing expedition with one man to Cape Crozier, about 100 miles distant, to put down a large depôt. The latter was for use on his sledge-journey to the east coast of Victoria land, planned for the spring of 1905. Gustav Wiik had all this time had sole charge of the magnetic observations of the station, and had done excellent work. The summer was short and cheerless. The vessel slipped the ice on July 22. Of birds of passage we saw swans, geese, loons, ducks, eiders, and many small birds. The ptarmigan came in March and went in November, the only stationary animals were the Arctic fox, the stoat, and the lemming. The vegetation was rich, and large tracts were to be seen quite covered with flowers. There were butterflies, flies, and some other insects, not to omit several milliards of gnats. The winter set in somewhat earlier this year than the preceding one, and the ice formed a week sooner. The reindeer, of which there had been great numbers the previous autumn, were this year very seldom to be seen. The whole of our winter provision thus consisted in 1904 of only twenty deer, and these we had shot far inland, whereas, in 1903, we could have killed as many as we liked quite close to the vessel. However, the Eskimo, who had spent the summer reindeer-hunting in Northern America, brought us a quantity of venison, and from other quarters we procured salmon, cod, and trout, so that we were well provided for the next winter too. In the middle of October the Eskimo returned from their summer excursions, and then visited us in great numbers, but went off again to fish before the darkest part of the winter set in. Towards Christmas they returned to the vessel, and we then had the pleasure of their company for nearly two months. On November 20 we had a visit from an Eskimo family of a quite strange tribe. They proved to be Kinepatu Eskimo from Chesterfield inlet, near Hudson bay. The man's name was Atagala. He knew English sufficiently to explain that near where he lived two large vessels were lying. For an old Mauser rifle and four hundred cartridges he undertook to take a mail down to them and return with an answer, about 1500 miles. On May 20, the next year, a sledge-team of ten dogs swung into our harbour. It was Atagala. He brought us a mail from the *Arctic*, a ship belonging to the Canadian government, which was wintering at Cape Fullerton, in Hudson bay. She had originally been the *Gauss*, and was built by the German South Polar Expedition, but was now out to inspect and choose suitable spots for small garrisons. Major Moodie was in chief command, and Captain Bernier in command of the ship. An American whaler, the *Era*, was also wintering at the same place. Captain Comer, of the *Era*, and

Major Moodie sent me ten sledge-dogs, as I had written to the former, telling them that the greater number of our dogs had died in the course of the first winter.

During our seventeen months' intercourse with the Nechjilli Eskimo we became by degrees so intimate with some of them that they little by little lost the mistrust they usually have for strangers, and showed us complete confidence. We, however, never really acquired their language, and, consequently, could not thoroughly understand their life. What I have to tell about them, however, is based partly on careful observation, and partly on information from the Eskimo themselves, and this being the case, I venture to think that my information regarding one of the most interesting and least-known races of the world is correct.

ESKIMO BUILDING SNOW-HUTS.

What adds greatly to the value of these searches is the series of splendid photographs taken by Lieut. Hansen during our sojourn in those parts.

Nechjilli, which the Nechjilli Eskimo look upon as their home, are the banks of the great Willersted lake on Boothia isthmus, and of the little bit of river which flows from the lake into the sea. Unfortunately, we never had time to pay them a visit, but from the Eskimo's often repeated descriptions I know what the country looks like, and what their life is there. From the time the ice breaks up in June or July to January or February the next year, it is here that they live—in summer in their tents, and, when the snow falls, in their snow-houses. Often in transition periods, from winter to summer and summer to winter, when the snow—as it is in the month of June—is too waterlogged to be used for the building of entire snow-huts, they are obliged to use a construction the walls of which consist of snow and the roof of skins, a

combination of snowhut and tent; or, as often happens in September, when the cold strikes in and the lakes freeze before the snow comes, they are obliged to construct a building of ice with a skin roof.

When an Eskimo is about to build a snow house, he is always careful first to consult his "hervond." This is simply a stick of straightened horn taken from the antlers of the reindeer. At the lower end it has a ferrule of musk-ox bone, and at the upper a handle of reindeer bone. It is about a yard long. With his keen glance he now scans the country, and at the place which pleases him best thrusts his "hervond" into the snow. He does this in order to find out its quality, for it is as important for an Eskimo to find good snow for his building as it is for a bricklayer to have lime for his stone. A very long experience is required in order to test the snow in this manner, and, when several Eskimo are together, it is a task generally left to the oldest ones. The most suitable snow is that of a solid and compact kind, with a superincumbent layer of loose snow, about a foot in depth. Nor must the underlying snow be too hard, or it will be difficult to cut out the blocks. The site once chosen, the upper loose snow is shovelled away, and is laid round the spot where the house is to be. When the underlying hard layer is laid bare, the builder begins with his knife—which is usually long-bladed and long-handled—to cut out and build up the blocks. The house is constructed from inside, and the blocks are cut exclusively from the building site: it is seldom that an Eskimo has resort to the snow outside. The blocks are cut out of snow with a high edge, and that is the reason why the site can contain sufficient material. The hut is built spirally, in such a way that the succeeding block is always supported on a preceding one, and in shape much resembled a large beehive. Our greatest difficulty was always when we had to decrease and build the roof. The blocks are then placed in a very inclined position, one may say almost rocking. But the Eskimo are born to this way of building. Where one of them puts the block there it stays, even if it forms an angle of 45° with the horizontal plane. The structure is completed by a little, dexterously placed, plug of snow in the apex of the roof. After the house is up, there will be a mass of refuse snow lying inside it. With this the sleeping-bench and fireplace are made. Meanwhile, the lady of the house has not been without occupation outside. The loose snow, which was shovelled away at the beginning, she uses to caulk all the holes and cracks with, and if she has any to spare she throws it over the entire house, which helps a very great deal in making it warm and draughtless. When all is finished inside, an aperture is cut in the wall of the same height as the bench. The man comes out and the woman takes his place. First of all, the large watertight kayak-skin is handed in and is spread over the entire bench; then comes the turn of all the reindeer-skins—soft, large, and warm; then the rest of the effects, such as cooking-utensils, a drying-grill, blubber for the lamp, and a number

of other things which the Eskimo find indispensable. When all this is done, the housewife is walled in. It will be asked, What was this immured lady doing inside the hut? Perhaps it will not be indiscreet of me to poke a little hole in the wall and peep in. In the name of knowledge everything is permissible, so with a "ski" staff, which I happened to have with me, I made a hole in the wall and opened a way into the sight of this mysterious interior.

The first thing she does is to put the lamp in place and make a fire. After that she fills the cooking-pot with snow, and hangs it over the flames to melt into water for her thirsty husband. As soon as she is satisfied that the lamp-flame is burning to its greatest extent, she turns her attention to arranging other things, the sleeping-bench is levelled and flattened, reindeer-skins placed in order on it, and everything made as comfortable and cosy as possible. All being arranged, she seats herself before the fireplace and seems to be particularly anxious to make the fire burn as brightly and give out as much heat as possible. Now I understand why it is she is walled up in this house—in order to warm it and make the blocks of snow sink, so that the whole will form a close and compact wall. But she will certainly not succeed in this if I continued at my peeping, so I fill it up again and take myself off. Meanwhile, the man has built the passage, 9 to 12 feet in length, which leads into the house. But he will certainly not dare to make a hole in the wall and put it in communication with the interior of the house before he receives higher orders from his better half. He amuses himself meanwhile with his friends, who are in a similar situation, and whiles away the time in joking and conversation. They are a fine group of men who are standing there, ranging tall, from 5 feet 9 inches to 6 feet, though there are some short ones among them. They are powerfully built, the life they lead inducing all-round development. The ladies' pellucid voices are now heard, and the expectant husbands can complete their structures by knocking a hole through the wall from the passage to the hut.

Let us now pay a visit to one of these camps, and see what Eskimo life is here in these burrows of snow immediately after their construction. The huts are of different sizes. Some people like them high, some low. The circumference is from 30 to 45 feet, according to the size of the family. It is the month of January, and the cold is severe. They, therefore, live two families together, so as to be warmer. The members of the family have just assembled after the building operations and a long day's sledging. The housewife sits in her accustomed place and croons her monotonous chant, consisting of four words and as many notes, which are repeated in varying forms. These sounds, when they are repeated often enough, we found unendurably monotonous. Politely to request them to be quiet was of no use; but we found another most effective means, namely, to give a vocal performance of our own at the

same time. Then we had peace, for our many tones, no doubt, sounded as awful to Eskimo ears as their four did to ours. Well, this was not very polite on a first call, but, anyhow, they were not offended.

The first thing an Eskimo does when he enters his hut is to take off his outer coat and beat all his clothes quite free from snow. This he does so that the latter shall not have time to melt and wet his clothes. If he intends to be in the whole evening, he takes off his other outer garments. If any of them have become wet during the course of the day, they are thrown to the lady of the establishment, who puts them up on the grill to dry. His hunger has now to be appeased, and the most tempting pieces of meat and fish are brought out—of course, frozen stiff. But this does not affect the Eskimo in the least; once down it melts soon enough, and enormous quantities disappear. Their knives are their only eating implement, but these they handle with dexterity. They hold the piece of meat fast with their teeth and the left hand, and with lightning rapidity pass the knife right under their noses, and cut off a piece of meat so close in to their lips that one is astonished that the latter do not go too. One large bit of blubber after the other goes the same way.

The family having thus finished this important business, a nap will possibly be to their taste, and the entrance is carefully bricked in from the inside. They now proceed to undress till they are quite naked, and then sleep the sleep of the just under large coverings of reindeer-skin shared in common, possibly till late the next day. This, however, depends upon whether they have enough food. If the man intends to live here for any length of time, he chops himself a window the following day out of the ice on the nearest fresh-water pool, and inserts it in the wall immediately above the entrance. His dame can then see to do her work by daylight. She has plenty to look after. She sits by the fire, which is her accustomed place, with her legs tucked up under her, and watches the flames and her offspring, who are running in and out playing. She smiles and looks absolutely happy. Probably it is the two small physiognomies, encrusted with soot and train-oil, which call these pleasant thoughts. It is not so long since the youngest left her hood, where children are carried till they are about two years old. Their play grows less by degrees, and the youngest one goes up to his mother and looks inquiringly in her face. She knows her boy, she does. The children here are not weaned so quickly, and mother's milk is to their taste long after they begin to walk. I have even seen boys ten years of age lay their arrows aside and take part in the repast.

But see, here comes a friend, of the same sex, of course. She has come to pass the time of day; is bored, perhaps, in her own hut. It is Alo-Alo, a young and attractive woman. The sharp cold has given her a fresh colour, and the pretty brown eyes with the blue whites look very much as if they could hide something behind them. Out of her

hood sticks up a little wondering face; it is her year-old son "Akla," or the brown bear. Conversation is soon in full swing, and the two women seem to have a great deal that is amusing to tell one another. Suddenly the baby in the hood begins to move, and with incredible rapidity and quite unparalleled adroitness changes place from the hood to his mother's lap. He has his wishes complied with, and is going to be put back in his warm, cosy place, when his mother discovers that he is more than usually dirty to-day. The washing process which then takes place must

ESKIMO IN SNOW-HUT.

be very practical when water is scarce. She licks the child clean, and then puts him back. If it has been a fine day, the men have been out on the ice to capture seal, and are now coming back in the dusk. They seldom return home empty-handed, but have a seal or two with them, which are then handed over to the housewife, who has to see to their partition. The entrails, which are the greatest delicacy they know, go to the one who has caught the seal; the rest is divided among all. After supper they often require a little diversion in the long winter evenings.

They then assemble in the largest hut, and spend a few hours together, singing and dancing. These huts are often quite handsome structures, and I have seen them 14 feet high and 25 feet in diameter. On these occasions the women all sit round in a circle and begin their monotonous chanting, the men entering the circle one by one to perform a kind of solo dance, beat a frame covered with thin tanned reindeer-hide, and scream something perfectly dreadful. What astonished me most at these festivities was the singing of the women. I had always thought that all their tunes—or rather variations on the five notes—were impromptu, but here I had certain proof that they really were songs, for I heard as many as twenty women singing together at these gatherings for a whole hour at a time, without any of them falling out of the melody. In my opinion this almost points to musical gifts.

The next evening the magician of the tribe will perhaps give a representation in the same hut. This is a very serious affair—the only performance we never had an official invitation to. We tricked them all the same, and found out what went on. The hut is made almost dark, only quite a little flame being allowed to burn, which, of course, made things the more mysterious—complete darkness would be too dull. The magician and his assistant (usually his wife) take their places on the bench, and the company sit at the other end of the hut. Absolute darkness broods over the performers. The two now begin to utter loud howls, and, on the whole, lead one to suppose they are killing one another. After this farce has been going on for half an hour the noise grows less, and by degrees everything becomes quiet. The light is made stronger, and, to the apparent surprise of everybody, the magician now exhibits two holes in his coat, which, before the light had been subdued, was quite whole—one hole in his chest and the other in his back, and they go to prove, of course, that during this turbulent scene he has run himself through with his spear. Judging by appearances, the Eskimo all take this very seriously; but when later I joked with them about it they laughed and said that the whole thing was nonsense.

Any real sign of astonishment these people seldom show. One of the few times that I can remember seeing any trace of this was when I sent a messenger to the ship—I was then in camp about 10 miles away taking magnetic observations—with a letter in which I asked for a certain quantity of ammunition. When he returned the next day and I told him before he gave me the consignments that I knew how many cartridges he had with him of each kind, and that he might count them himself, he was astonished to see that I was right, and much impressed by the use we put our writing to. They often amused themselves later by scribbling some strokes on a bit of paper and giving it to us. We always pretended to be highly astonished, and read it out loud; this greatly amused them. Family life gave us the impression, as a rule, of being happy, though I know of cases where the husband ill-treated his

wife. The male sex being so much more numerous than the female, it was not unusual to find marriages where the wife had two husbands. The reverse relationship I never met with. In general, the husband was spokesman and the wife obeyed blindly, but elderly widows were sometimes personages of great influence.

The religious opinions of the Eskimo were like our own in that they had an understanding of a good and an evil being, of punishment and reward. If a man had behaved as he should in this life, then he would go to the hunting-fields in the moon; and had he been a bad man he must go under the earth. During the whole of our stay among them there only occurred, as far as I know, four births and two deaths. The latter, in both cases, being suicide. It is not considered to be wrong; but is, however, only resorted to when the pain in an illness is too great to be borne. The way in which they do it is, I think, peculiar to them alone. A sealskin thong is stretched across the hut 2 feet above the floor. The sick person is left alone in the hut and the others go outside; they, however, have peepholes in the wall, through which they follow events. The sick person now kneels down and endeavours to suffocate himself by pressing his throat against the strained thong. If the unfortunate person is unable to do the business for himself, or it seems to be taking too long, one of those outside comes in and expedites matters by pressing his head down on the thong. Fighting with closed fists occurs now and then, and murder is not unknown. It thus happened in the summer of 1904, at the station, that a boy twelve years of age accidentally shot another boy of seven in a tent. The father of the boy who was killed immediately seized the other, who, for that matter, was his adopted son, and dragged him out of the tent and stabbed him to death. Their dead they sew up in a reindeer-skin, and lay them on the ground. A few articles, such as a bow, spear, arrows, and other things, are placed beside them. We found many an interesting object in this manner.

On April 2, Lieut. Hansen and Sergeant Ristvedt started on their sledge-journey to chart the east coast of Victoria Land. They had two sledges, twelve dogs, and equipment for seventy days. The provisions were measured as shortly as possible so as to reduce weight. All the same, it is very necessary on a long journey of the kind that everything should be carefully planned so as really to hold out the requisite time. The depôt, which had been made the year before, had been entirely spoiled by bears, but Lieut. Hansen and his companion shot bears, seals, and reindeer, and thus spun the journey out for eighty-four days. Excellent work was done. The east coast of Victoria Land was charted right up to the 72nd parallel. The land, formerly seen by Dr. Rae, at the south end of Victoria Strait, proved to be a group of over a hundred small low islands. These were charted on the way back. An interesting event from this journey was the meeting with another unknown

Eskimo tribe, the "Kiilnermium Eskimo," whose hunting-fields extend from the Coppermine river eastwards. These Eskimo, like the others mentioned, have no connection with civilization. We, of course, received our bold companions with flags waving on their return, and a feast to commemorate it.

On June 1 we dismantled the observatory containing the magnetic self-registering instruments. For nineteen full months Wiik had kept this going, and had done work which will, without doubt, be rich in results.

On August 13, at three o'clock in the morning, we continued our way westwards, and I am not sure that the little brown-eyed people in there on the beach were quite cheerful that morning. Hardly, for they were losing several rich and great friends. They waved long to us—probably a farewell for life; and if some traveller, many years later, pays this place a visit, the numerous tent-rings will remind him of the many happy days the *Gjöa* expedition spent here with their friends the Nechjilli Eskimo. The day afterwards we stopped at a place called by the Eskimo, Kamiglu. Here we took an Eskimo boy named Manni on board. He won us one and all by his openness and honesty; and even the cook, who hated Eskimo, had I think a warm feeling somewhere at the bottom of his heart for him. It was my intention to bring him home and show him a little of the world he could never have imagined, and to send him back again, in the event of his wishing it; but he was accidentally drowned at Herschel island. After passing through narrow and shallow waters we came out, on August 21, in Dolphin and Union straits. Now we could breathe! On the forenoon of August 28, we sighted a sailing-ship. It was a proud moment for us all when we hoisted our flag and bore down on the American.

On September 3 we were stopped by ice at King Point, and soon after that were beset for a third winter. However, we were in high feather all the same; on the shore lay the finest driftwood that could be desired, the sea was full of fish, and not far off there were hares in thousands. On the shore, some fathoms in past us, lay the nipped whaler *Bonanza*. The first thing we did was to build ourselves a house of drift timber, and after that the observatories were put up. From October 20 to March 12 I was out travelling with the *Gjöa's* mails, Lieut. Hansen having command on board meanwhile. This winter was exceedingly severe and disagreeable. On my return everything was in the best order; but on March 26 Wilk became ill and had to take to his berth. He died on the 26th. It was a hard blow to lose a comrade so near home. It was not until May 9 that we were able to bury him, the ground up to then being too hard frozen. In the mean time his coffin stood in our dwelling house on shore, which we gave up to it, nailing up the door. Later on we put up a large cross with an inscription on it at the north end of his grave, and when the flowers came, decorated it

with them. It is situated on a very prominent point, and will be a landmark for the numerous ships which pass by it.

The spring was a cheerful time. The continual passage of Eskimo and whites made the time pass quickly. On July 2 we got out of the ice, and brought up under the *Bonanza*, so as to avoid the ice which was drifting backwards and forwards in the land lead.

On July 11 two of the American whalers came to our place to collect driftwood, and the same evening we stood out. We took a last farewell of our comrade whom we were leaving behind us out there, and dipped our flag as a last mark of honour to him as we passed under his grave. Already at Herschel island we were stopped by the ice, and were kept there a whole month. After many narrow passages and abrupt turns, we stood down Behring strait on August 30. The day afterwards we went into Nome, a gold-digging town in Alaska. The reception we received and the enthusiasm our enterprise had aroused there we shall never forget.

On September 5 the *Gjöa* set sail southward under Lieut. Hansen's command for San Francisco, and on the 7th I left with the magnetic instruments for Sitka, in order to conclude our work. On October 19 we met again in San Francisco, where we confided the vessel to the hands of the American navy. There rests the old *Gjöa*, and greatly does she need it.

Before the paper, the PRESIDENT: I shall say little on the subject of Captain Amundsen's very remarkable explorations, as the paper will speak for itself, and you will hear what highly competent experts think of these explorations when we come to the discussion, which, I am glad to say, will be joined in by his Excellency Dr. Nansen, by Admiral Sir Vesey Hamilton, by Sir Allen Young, and a number of other well-known Arctic authorities. But it strikes me as extraordinary that only seven men should start away in a very small vessel and live a number of years in the Arctic Regions, and do the remarkable work they have done. I must say a few words about Captain Amundsen's preparation for this work, and the foresight he displayed. Many years ago he went on a sealing expedition into the Arctic Regions for no other purpose than to prepare himself for his recent work. Later on, as he advanced in his ideas and felt that examination into the conditions around the magnetic pole was to be the main object of his explorations, he went to Hamburg, where he put himself under the tuition of Dr. von Neumayer, one of the greatest living authorities on magnetism, and he devoted a long period to studying the subject, and it is typical of Captain Amundsen's character that his first step in the present expedition was to purchase and select his magnetic instruments. As another means of preparation for Polar work, he went as first officer in the *Belgica* to the Antarctic Regions, and remained there for two years. In conclusion I must point out that, as an incident in his recent explorations, Captain Amundsen passed through the North-West Passage in the first vessel that has ever sailed through it. I wonder what would have been the effect a century ago if it had been announced that some one was going to address a meeting describing his voyage through the North-West Passage? I do not think the Albert Hall would have sufficed if it had existed in those days. I now call upon Captain Amundsen to read his paper.

After the paper, his Excellency Dr. Nansen: The way in which you have received my compatriot, Captain Amundsen, shows a hearty appreciation of the deed he has done and the most interesting lecture he has given us here to-night. As Captain Amundsen has already pointed out himself, the fact that it has been possible for him to accomplish that great deed is due entirely to the work of British seamen. It is due to the enormous amount of work already done in that region by many British expeditions sent out in search of a North-West Passage. But a Norwegian has been the lucky man to finish this quest for the North-West Passage, and has been the first to pass through it with a vessel. It shows us a good example of the way in which British and Norse sailors work together. When we look back upon the centuries that have passed, it is, in fact, a remarkable thing how the one has always succeeded the other. The first step in this direction is very long back. The first step in that exploration to the west was, in fact, the discovery of Iceland. That was made by people from this country, by Irish monks, in the beginning of the eighth century; but not long after that came the Norse Vikings. They also discovered Iceland by an accident more or less, and I am afraid they did not treat the Irish monks very well, because they all disappeared; but the Norsemen kept the ground, and from Iceland they discovered Greenland, and formed settlements there for several centuries, and from Greenland they were the first to discover America, Newfoundland and Labrador—that was about the year 1000. And on leaving those regions they sailed through Davis strait, and sailed far north into Baffin bay, and their settlements disappeared altogether. Then again come the English, who opened a new campaign in the year 1497 with Cabot's first famous expedition. And you go on westward always in quest of the same goal—the North-West Passage—until the great search of the Franklin Expedition. Then come the Norsemen again, and they finish; and it is a strange thing to remember that both these great quests of this seafaring nation, the North-East Passage and the North-West Passage, have been made by two Scandinavians—the North-East by a Nordenskiöld, and the North-West by an Amundsen. But the fine thing is the way you are able to appreciate what little we have done, and I think we may say we belong to the same race; and of these series of gallant achievements we may say with Tennyson—

> "One equal temper of heroic hearts
> Made weak by time and fate, but strong in will
> To strive, to seek, to find, and not to yield."

We have here to-night the last representative of this type of man, and a very good representative indeed. I knew Amundsen before he started, and I have seen him preparing for his expeditions. He mentioned my name in his paper, but he said far too much about me, because what little I was able to do was only of slight importance. He was the man who planned the expedition, and he has learnt the secret of success in Arctic expeditions—that is, in the planning first and then in the preparation. The way in which he prepared the expedition is very characteristic of the man. As our President has already pointed out, the first thing he did was to learn to make his scientific observations, and the next thing was to buy scientific instruments, and the third thing was to buy the ship. It is generally the opposite way with explorers; they go first for the ship, and when they get that they try and get a little scientific training before they start. He has carried out his expedition with the same thoroughness that he prepared for it. He could have done the North-West Passage long before he did, and for many a man it would have been too tempting to make for the North-West Passage, knowing it would be appreciated by the public, instead of making scientific observations, which, I am afraid, very few of the public and of you appreciate as they ought to be

appreciated. Amundsen came on his voyage to the Harbour, where he stayed for two years. The sea to the west was open, the North-West Passage was open to him, but he stopped for two years and did what he had come to do—make his magnetic observations in the neighbourhood of the magnetic north pole; and then, when he had finished this part, he was fortunate enough to take the North-West Passage. In my opinion, when we want to send out a man to an unknown region where new exploration is to be done, he is the sort of man we should send; he knows what is of importance and what is not; he knows not to do sensational things when he has good work to do, but he can appreciate sensational things at the same time, as he has shown us. And we may see him start again on a new exploration, and I feel certain, next to his own country, he will have many well-wishers in this country, and I believe we shall all of us join in the words of Browning, and say—

"Greet the unseen with a cheer!
Bid him forward, breast and back as either should be,
'Strive and thrive!' cry 'Speed—fight on, fare ever
There as here!'"

Admiral Sir VESEY HAMILTON: I am sorry it has not fallen to the lot of some one more capable than myself to give expression to the very high opinion we have of the wonderful work done by Captain Amundsen and his seven followers. I do not think an Arctic expedition ever did so much with such small means, and the character he gives his men is something admirable. One of the reasons of the success of the expedition was that every man had his heart thoroughly in it; therefore, instead of seven men we may say there were fourteen or twenty-one. With regard to the magnetic observations, I see somebody here who knows a great deal more than I do about them, and so I shall skip the greater part of them. The vessel was probably the smallest vessel that has ever navigated the Arctic ice, even in the days of Baffin. I am perfectly sure none of them had so few men. One thing particularly striking is the contrast between the Eskimo of the north coast of America and the Eskimo of the Labrador coast and of Greenland. That in itself would form an interesting subject of inquiry. It was very interesting to me to hear the lecturer's observations about Beechey island, because your late President and I went ashore there. I have had the experience of three Arctic winters and five Arctic summers, and I can say that nothing I have heard of surpasses the work of Captain Amundsen. In every way "'Tis not in mortals to command success, but we'll deserve it." And Captain Amundsen has deserved it. It is a great thing when a general not only looks ahead, but looks astern. With regard to the dogs, all I can say is, I have had 2000 miles' travelling with dogs, and I am sure if Job had been there his patience would have been exhausted. I think I need say no more. The enthusiastic manner in which you have received Captain Amundsen's lecture shows the great interest you felt in it, and I am sure I am not taking too much upon myself when I assert that every one here present will look forward to the full results of the voyage with the very greatest interest.

Sir ALLEN YOUNG: I think we cannot be too grateful to Captain Amundsen for the most interesting narrative he has given us to-night, and especially when we consider the results of his expedition. One point which Dr. Nansen made was greatly to the credit of Captain Amundsen—that when he arrived at the point of the hemisphere at which the Passage was open to him, with every prospect of going through in one season if he had intended to do so, he abandoned all idea of that, and determined, in the cause of science, to remain for eighteen months in the neighbourhood of the magnetic pole in order to make further observations on the inclination and horizontal force, with the object of determining any variations in

the position of the pole itself. No doubt the scientific results will be very valuable when they have been carefully worked out, especially, we hope, they will indicate if there is any variation in the position of the north magnetic pole. It was suggested by Ross in 1831 that those poles are supposed to have an area of about 50 miles in diameter, for which there is no apparent horizontal force. The most marvellous part of this journey was that it was completely without check. In 1858 I was navigating with Sir Leopold McClintock, and our object was to get round to King Williams Land, but we were checked about 25 miles down by a solid barrier of ice. Then we tried the alternative way of going round by Port Leopold, and after several attempts we succeeded in getting there; but we were again faced with ice, so we had to go back and find our winter quarters on the east side. Now, it seems to me that Captain Amundsen went straight down, and I think the way in which he escaped and got through was most marvellous. Captain Amundsen, however, did not neglect the opportunity of making geographical discovery, for he sent a travelling party under Lieut. Hansen to Victoria Land, which successfully filled in the gap between Collinson's furthest up, Gateshead island in 1853, and the discoveries of McClure in 1853, and added to our knowledge of the western shore of McClintock strait, which can now be mapped out on both shores. I should like to ask Captain Amundsen if he was able to gather knowledge, retained by tradition among the Eskimo or from information by some of the older natives, of the ultimate fate of the crews of Sir John Franklin's ships, or if he found any relics or papers which could throw additional light upon the disastrous return of those gallant men, or the actual position of either of Franklin's ships in which they ultimately sank or were driven on shore after being abandoned. Well may all, and especially those who have had experience of Arctic seas, offer their heartiest congratulations to Captain Amundsen.

Captain CREAK: I think I will begin by saying that I entirely endorse everything that has been said about the gallant and sailor-like conduct which characterized the work carried on by this expedition. It seems perfectly marvellous to me that a vessel of this size should have been taken across the Atlantic, up Davis strait, through Behring strait, and then on to San Francisco. I think it is a sort of passage that will stand as a record. The chief object of the expedition was to make a magnetic survey of the region of the north magnetic pole, which had been approximately found by Ross in 1831, for there had been a controversy going on upon the question of its movements for years past. Some people, who thought they knew something about the matter, depicted the magnetic pole as a sort of wandering Jew going about the Earth and not knowing where to stop. Great mathematicians had been at work, but they never gave a fairly satisfactory solution. This expedition was therefore planned to determine existing conditions during two years. Nothing but observation would do it. Captain Amundsen, having arrived at Beechey island—a position where there came the parting of the ways—had a momentous question to decide, to turn northward or southward. Fortunately he had an excellent sign-post which came to his assistance in his magnetic instruments. Theorists said go north, but the magnetic instruments said go south. Amundsen obeyed his excellent mentor and went south down Peel sound. Off Prescott island his compass became useless. Nowadays we hear of a mass of 18,000 tons of steel and iron, namely, the *Dreadnought*, being steered across the Atlantic, guided by the compass; why should not this wooden ship be guided by the compass? You must remember this—that the *Gjöa* had fittings of iron. If she had one degree of error to start with, by the time she reached Beechey island she would probably have twenty-five or thirty, which would be quite enough to entirely destroy the action of the compass. The *Dreadnought* was taken over her ground with certainty, because as she proceeded

the Earth's directive force on her compass grew stronger; with the *Gjöa* the directive force became less and less, and she lost it entirely close to the pole. But supposing the *Gjöa* had been entirely free from iron, it may be of interest to follow the behaviour of the compass when she was being steered geographically due south. In Peel sound the compass would indicate a course about N. 30° W.; off Cape Colville, S. 40° W.; at Gjöahavn, south. Consequently in that short distance the compass north would—geographically—point in nearly an opposite direction, and be of little practical use as a navigational instrument. Thus I have tried to explain why the compass is practically useless after we come to a certain point, due partly to the iron in the ship and partly to there being no directive force. Now, Captain Amundsen arrives and gets his ship moored, and he mounts his magnetic instruments. From what he has described, I gather he had a most splendid set. There were differential instruments which were going for nineteen months, which tell us for every moment of the day what the direction of the needle was and the changes in the force directing it. Probably the declination of the needle was changing 10° either way—10° to the left and 10° to the right of magnetic north, and at about 7 o'clock in the morning, and at 1 or 2 o'clock in the afternoon respectively. Still more important were the excursions he made, so that he could give a most valuable account of all the magnetic conditions surrounding him. He certainly, so far as I can see, found out where the pole is for one epoch, but there is still some doubt as to whether it is a fixed point or not. That remains to be proved. It will require years to get the observations into form, but I think we have every hope that eventually we shall be able to find out what magneticians have been wishing for for many years. We shall have found out where the magnetic pole is, and also what is going on there. I am also happy to learn that they made a series of meteorological observations. It will be interesting to know, also, what work has been done in connection with geology—I think Captain Amundsen had a geologist among his party. I should like to know whether he made any inquiry into the local magnetic disturbance of the region. The only other remark I can make now is, that I think it is very sad that Wiik has not lived to return to his native land after watching those instruments all those months, and witness the fruits of his labours. I will now conclude by saying that Captain Amundsen and his comrades have accomplished the task they set out to perform, and that the whole of the expedition may be described as having been conducted with the highest enterprise, judgment, and courage. May I add one more remark, and that is that this expedition was sent out entirely for magnetic purposes, but in addition to those magnetic purposes it has done good work for geography; cannot geographers do something for magnetics?

Admiral FIELD: Captain Creak has gone so very thoroughly into the question of the magnetic part of the observations, that really I am afraid there is very little for me to say in the matter. I am sure the observations of Captain Amundsen, when they are worked out thoroughly, will be of the greatest service in improving our magnetic charts. We are sadly in want of those observations. It is only within the last year that we have had the south magnetic pole fixed satisfactorily. That is a very great advance, and I may say that the Admiralty are paying great attention at the present time to the question of magnetism. The officers are being specially instructed in the subject, and we are taking advantage of recent long cruises by a squadron going across the North Pacific, down the coast of North and South America, making continuous observations the whole of the way; also from Newfoundland and across the South Atlantic ocean. So that we are making great progress, I am glad to say, in magnetic work, and these observations with regard to the poles, both north and south, will assist us very materially, and I am sure all

magneticians will be very grateful indeed to Captain Amundsen for his labours. I can only say, with regard to Captain Creak's last remark, I quite second that, and I hope the explorers that the Geographical Society send out will bear in mind the needs of magnetism. I will conclude by saying that, at the suggestion of the president of the Geographical Society of the Pacific, and with the concurrence of the President of the Royal Geographical Society, the name of "Amundsen gulf" has been given in the Admiralty Charts to that part lying to the south of Banks island, in commemoration of the voyage which has just come to such a successful conclusion.

The PRESIDENT: The hour is late, and I feel sure, after what his Excellency the Norwegian minister and the other speakers have said, it will be quite unnecessary for me to add one word to express the intense admiration we feel for Captain Amundsen and his exploits. I will only, therefore, ask you to join in a hearty vote of thanks to him.

Captain AMUNDSEN: I speak English so badly that I hope you will excuse me if I thank you in only a few words. First, I should like to answer a few questions put by Sir Allen Young. He asked if I had any information about the Franklin Expedition; but I have none. The Eskimo did not know anything about the members, but I got some information about one of the ships. Two of the tribe found the vessel in the winter-time when they were out seal-hunting, and they took as much of the iron and wood as they could get from the ship, and of course, when the spring and summer came and the ice melted away, the ship went down. Captain Creak asked if I had any geologists on board. Yes, I had one, but he had nothing to do, the land consisting of sand all the way. I should like to take this opportunity of thanking the Royal Geographical Society for the invitation to lecture here to-night, and for the great honour they have shown me; I thank you for the kind sympathy you have shown me during the reading of my paper.

CUTCH AND THE RAN.*

By ROBERT SIVEWRIGHT, F.R.G.S., late Public Works Department, India.

AT the time of Alexander's military raid into India (325 B.C.), a group of islands, seven in number, lay off the western coast of Hindustan between 22° 45′ and 24° N. lat. and 68° 30′ and 71° E. long. These islands, as such, have long ceased to exist; they are now joined up together and with the mainland by the alluvial tract known as the Ran, while only one of the seven has now a sea-coast. Five of these one-time islands are called collectively Cutch or Cutch Bhuj, the remaining two form part of the province of Guzarát.

I spent some months in Cutch and on the shores of the Ran, and will endeavour in this paper to briefly summarize the information obtained about the province and its inhabitants during my journeys through the country. Making Wadhwan, a station on the Bombay Baroda and Central India railway, my point of departure, I collected tents and camp equipage of all kinds, as once the railway is left behind the traveller has to

* Research Department, February 8, 1907. Map, p. 596.

rely entirely on his own resources in this part of India. Having Mallia as my objective in the first instance, I made marches of usually some 10 or 12 miles a day when moving camp. The route taken lay through the black cotton soil plains of northern Kathiawar: crossing as I did the drainage of the country, the opportunity was afforded of taking longitudinal and cross sections of the rivers flowing northwards into the Ran, and estimating their discharge as well as noting their other characteristics. I halted at Dhrangadra, a large and thriving town, visiting the Raja, who received me hospitably and gave me every assistance while in his state. I also spent an afternoon at Morvi, when I went over part of the Thakor's palace, and was no little surprised to find the reception rooms furnished by a London firm. At a subsequent date I visited Patri in connection with my study of the salt deposits in the Ran, and would draw attention to the hot springs on an island in the Ran 10 miles to the north of the salt-pans near that town. I regret that I had not an opportunity of visiting them, as their position in such an environment seems very curious.

On approaching Mallia the ground fell gradually towards the Ran, a sandy belt some miles in width, characterized by low hillocks of blown sand, was traversed, and the Ran was reached. When I crossed the 5 miles of Ran about midday, the *mirage* was so intense that the low sandy coast of Cutch was invisible from Kathiawar; but the direction to take was given by the track used by the natives. Any travellers diverging from this track, in the absence of a compass, would certainly have lost themselves, and wandered about or have been compelled to halt until the air cleared at sundown. Cultivation was reached in Cutch, after crossing about 2 miles of blown sand, and camp pitched at Shikarpur, a village very typical of some eight hundred in the province. A cluster of some sixty houses, walls either of sun-dried bricks or rubble stone set in mud, roofs flat, formed of bamboo matting and mud plaster—a type common in Sind and where there is a scanty rainfall—two or three houses of a more pretentious style owned by the headmen of the village, whitewashed and two-storied; half a dozen bannias shops, where grain of all kinds, grown locally, could be bought, as well as sugar and ghee; the whole settlement surrounded by a thick thorn hedge, to contain at night the cattle, sheep, and goats of the village. Outside the village one large tree shading the chief well, from which the water-supply is drawn by the simple method of lowering with a cord a brass vessel called a *lota*, which when full is carried home on their heads by women. A few other wells will be seen here and there, within a radius of a mile or so from the village, from which water is drawn in a *moth* by bullocks at proper seasons for the crops. But the soil is nearly everywhere poor, and supports only the coarser grains and, curiously enough, carrots, which are raised in great quantities and used for feeding cattle. Ghee (or clarified butter), so

largely consumed by natives all over India, is chiefly imported from the Thar and Parkar districts across the greater Ran; and when I say that gur, or coarse sugar, cloth, and hardware are imported by native craft or an occasional steamer touching at Mandvi, I have completed the list of the villagers' simple wants. The typical villager but seldom, if ever, leaves his village even for a night. In the morning he will go out to his fields, and in the evening he will return from his work; and during his lifetime one day passes just like another. His life is one monotony. The failure of his crops is the one catastrophe he fears, for he then has to subsist on his scanty savings and the sale of the family ornaments; when they are gone he has to appeal to the money-lender, and further add to that debt which already hangs like a millstone round his neck. So much for the peasant; but I believe the Cutchees are, on the whole, at least as well to do—perhaps better off than an equal population taken haphazard in the agricultural districts of India outside the canal-irrigated areas.

Until absorbed into the sphere of British influence in India, the population of Cutch was kept down by wars civil and external, by famines, and infanticide. To famines the country will always be liable, a rainfall of as little as an inch having been known. The last great famine and plague reduced the population by thirteen per cent., but prior to their occurrence in 1899–1900 the number had increased by some 40,000 in ten years, the total in 1891 having been 558,415. Infanticide was very difficult to stop; treaty obligations to suppress it were undertaken by the Rao, though unwillingly, but it was not until Sir John Malcolm, in 1831, went to Bhuj and threatened that unless the custom was put a stop to once and for all, he would withdraw the British guarantee for the political autonomy of the province, that it practically ceased. The effect was immediate; the proportion of males to females, which in 1842 was as eight to one, in 1852 was three to one, and in 1868 1·04 to 1·0, or about the normal. Taking the figures given above for the population in 1891, we find that over eighty per cent. are scattered about the country among 928 villages, none of which have more than three thousand inhabitants; many have not more than a couple of hundred.

For generations the Cutchees have been acknowledged to be the finest seamen on the coast of India; this was recognized even so far back as the times of the Emperor Jehangir, who exempted them from paying tribute on their undertaking to convey to Mecca, free of charge, such pilgrims as should pass yearly from neighbouring provinces through Cutch on their way thither. From the middle of the eighteenth century their ships became superior in construction and design to other native craft, an enterprising Cutchee about that time having visited Holland and brought back with him a knowledge of improved methods of shipbuilding which he imparted to his countrymen. They imported slaves from

Africa for military service until stopped by the East India Company, who, also, at the same time as they guaranteed in the treaties of 1816 and 1819 the autonomy of Cutch, attached the stipulation that the Rao's government should put an end to the piracies for which the seafaring population had been notorious for generations.

Mandvi, the only seaport worthy of the name, with 38,155 inhabitants, is a thriving and wealthy town; it has a large coasting trade owning some 250 native craft, with an aggregate tonnage of 10,087. The larger vessels make voyages during the fair season, as they have done from time immemorial, to the Persian gulf and even to the coast of Africa. The exports by sea in 1897–98 were valued at twenty-five lakhs of rupees, the imports at seventy lakhs. The chief manufactures are silver filigree work and embroidery, but in recent years ten cotton presses have been erected at Mandvi. There is now a high school of art, and scattered about the province are one hundred and thirty-four schools with just over seven thousand pupils. The gross revenue of the country, which in 1853 was fifteen lakhs, is now over twenty-five. The other towns deserving of special notice which I visited at different times during my travels in Cutch, are Anjar (population 14,433), the first of importance I reached after crossing the Ran at Mallia; Bhuj (population 25,421); and Bhadresvar, 12 miles north-east of Mundra. Anjar is a walled town, which became the headquarters of the Political Agent on the ceding of that district (afterwards given back) as a security for the payment of an annual subsidy for the cost of a British force left in the country to maintain order in 1819; it gives one the impression of being a decaying place, and perhaps is chiefly of interest as the scene of military operations by British expeditions into Cutch. Bhuj the capital has, of interest, the Snake temple on the top of the ridge, from which a fine view is obtained of the surrounding country; the Rao's palace, a gorgeous pile which was designed by an English architect, and on which no expense has been spared: Italian artists, even, were employed in the decorations of the roof of the great hall. Here, also, are the native infantry lines for the regiment stationed there, and a church for the few Christians in Cutch—under fifty in the whole province, and this number made up of the officers, political and military, and their families and staffs. Bhuj suffered severely in the earthquake of 1819; it is stated that 7000 houses were destroyed, and that over 1100 people lost their lives.

The country was probably never very rich in remains of antiquarian interest, and earthquake convulsions must have ruined many of the oldest buildings in Cutch, but there are a few very ancient temples at Bhadresvar; one temple may, with some confidence, be stated to have received its name as long ago as 730 A.D., and there are other remains dating from possibly the sixth century. At Kanthkot there is a temple of date A.D. 1280.

As the general configuration of the country has been largely determined by the lithological character of the rocks and their stratigraphical features, I have indicated in the accompanying map the general distribution of the formations. Broadly speaking, the whole of the northern half of Cutch, including Wagir and the islands in the Ran as well as two areas in the district of Chorar, are of the Jurassic period. My suggestion, which I will develop presently, that the Ran is of deltaic origin appears to be partly supportable from the evidence these strata afford. The oldest or lowest of these rocks probably correspond to the Bath Oolite of England. They presumably overlie the crystalline rocks, of which an example occurs in the Syenite forming (as shown on the map) the Kalinjur hills (height 1165 feet) in Nagar, and which it is not too much to assume extend far underneath the Ran and Cutch, supporting the whole of the Secondary and newer formations. They form a series of strata 6300 feet in thickness: the lower half consists of limestones, Oolites, shales, and sandstones of marine origin; the upper of sandstones, shales, and conglomerates with land plants. They contain 177 species of Cephalopoda, of which 50 are common to Europe.

The Jurassic formations are followed by 2500 feet of stratified traps; these were accumulated at great depths in the ocean. No single instance of an old volcanic cone has been observed within these traps, nor any such local arrangement of the beds as would indicate the former existence of such among them. Dhenodur hill (1268 feet) has been mentioned in papers on Cutch as an example of an extinct volcano, but, as a matter of fact, it is composed of white sandstone with a capping of basaltic trap 180 feet thick.

The watershed of the province lies in the Jurassic and Trappean areas, and this has some fine peaks along it; for example, the Waora hill, 1142 feet, 15 miles west of Anjar, and there are several others in height between 700 and 1000 feet. The middle third of the width of Cutch contains the elevated part of the province, and this may be taken as averaging 550 feet above sea-level.

The general configuration of the country has been determined by its geological structure, for almost every change in the bedding of the rocks is accompanied by alteration in the form of the ground; further, atmospheric agencies have produced unusually marked effects owing to the character of the rocks; but most marked of all is the influence on the configuration of the country caused by the great fault which runs along the northern face of the Chavar and Katrol range. Igneous intrusions have decided the forms of many isolated peaks, in some instances even producing minor ranges which traverse the country for considerable distances. In the plains of the interior the sedimentary rocks frequently appear with gently undulating bedding, crags and scarps projecting above the surface. The southern plains coincide with the Tertiary rocks; these, from the softness of their nature and horizontality of their

undulating beds, have doubtless favoured the production of this form of ground.

The scenery of the hilly country is exceedingly pretty; some of the wooded gorges to the west of Bhuj remind one of the Trossachs in Perthshire. And from the numerous peaks extensive and beautiful views are obtained; the sunset effects I occasionally witnessed were gorgeous.

It is usually stated, in Gazetteer descriptions of Cutch, that trees are rare and the country is barren and sterile, but such is not my experience. The hilly country which occupies the greater part of the centre of the province is beautifully wooded, and the isolated hillocks which rise from the plains are usually clothed with vegetation. There are jungles of babul trees; peepal and banyan trees are common at the villages. These are often of enormous size; I frequently camped under a tree which would have afforded perfect shade to a dozen large tents, and so thick were the stems growing downwards from the branches that the original trunk was often indistinguishable from the others. I have reason to remember my first march out of Bhuj, and incidentally the intricate character of the country and the thickness of the jungle. Having started off from my camp early in the morning to a village 16 miles off, after a day spent in Bhuj in the company of the last English people I was to see for some weeks, I started to join my camp, expecting on arrival to find my tents pitched and dinner ready. It was sunset when I reached the appointed place, but to my dismay the villagers knew nothing of my expected arrival; my camp had gone elsewhere. Night fell rapidly; the natives declared they could not find the track back to Bhuj in the dark, so I had to spend the night in an empty cowshed, without creature comforts of any description. This march (though not in its unfortunate ending) was a type of my camping along the watershed west of Bhuj. Some days the tracks were so narrow and bad that I had to give up carts for the conveyance of my tents, and trust to camels for which I had to send a long distance. Yet I shall always look back on the weeks I spent alone in camp in Cutch, sometimes as much as 60 miles from any European, as the most interesting time I spent in India. The programme of each day was much the same, the weather always being fine, and the nights cold and bracing. The tents were struck at 6 a.m., breakfast being taken under a tree while the camp was being packed into carts or on camels; after which on work all day, luncheon from a tiffin basket, and dinner sometimes not till ten o'clock at night. Towards the end of my tour I camped usually within sight of the sea from near Lakhpat to Mandvi. It was a grand sight to watch the waves breaking on the shelving beach: as the monsoon was at the time daily expected, a very high sea was running in the offing.

Many Political Officers have come and gone since the days of James McMurdo, but I found his memory still fresh, and his massive tomb on

the shores of the Ran has, for the last eighty years, been a landmark to travellers. The Honourable Company were fortunate in having a first-rate man in McMurdo as their Agent in negotiating their first Treaties with the Rao. The trade of Cutch was never sufficiently attractive to induce the Company to establish a Factory, and although an English doctor who was summoned from Bombay to attend the wife of the Rao in 1782 is believed to have been the first European to visit Cutch, McMurdo, on taking up his residence as Political Agent at Mandvi in 1809, first brought Cutch within the sphere of British influence in India. The Treaty entered into that year between the Honourable Company and the *de facto* rulers of Cutch—for the Rao was a lunatic and in confinement —was his handiwork, so also were those of 1816 and 1819. The task McMurdo took in hand alone, and at first with a mere handful of sepoys as a personal guard of honour, was the suppression of piracy by local authority, the restoration of order in Cutch—which at the time of his arrival was in a state of anarchy—and the dispersion of the banditti who had for generations harried the more settled and thriving adjacent State of Káthiáwar. Though he was reluctantly compelled to ask the Company to make a military demonstration into Cutch in 1815 to support him, and again in 1819, his great personal triumph was the laying of the foundation of British influence in the country.

Intervention in the internal affairs of an independent State was contrary to the policy of the Company, and, had it not been for McMurdo, would probably never have been sanctioned; but he, on the spot, discovered the imminent danger of an armed occupation of the Province by the warlike Amirs of Sind. McMurdo's anxiety lest he should be anticipated by them must have been very great. He was in time, but for months the question hung in the balance whether Cutch should be a State tributary to the British or to the Amirs. Had the latter established themselves, had Cutch become a stronghold of the Amirs, then Napier's position in Lower Sind in '44 would have been perilous in the extreme, in spite of the dearly purchased victory of Miani, and many pages of history would have to be rewritten. McMurdo's early death (he was only a Captain when he died of cholera, alone in camp on the shores of the Ran) prevented at the time any public recognition of his services; and these, even to this day, have been too scantily recognized.

What James McMurdo did in the domain of politics Alexander Burnes did in that of Geography: he laid the foundation of our topographical knowledge of the Province. When Burnes was sent to Cutch in 1825, a life-and-death struggle with the Amirs was known to be inevitable at no distant date. It was necessary to secure the passage of the Indus as an alternative line of communication with the North-West Frontier, and Cutch provided a strategic base for military operations in Lower Sind—at least, so it was considered at the time of Burnes'

arrival. He accordingly set to work to make himself thoroughly familiar with the country and people; his mastery of the native languages and his knowledge of surveying, equipped him thoroughly for his post. I do not find that he was instructed to map the country; in fact, he says himself that his survey of the country during the cold weather of the years 1825–28 was an "amusement." It may be that the British Government were well content that he should work quietly, and so avoid exciting the fears of the native rulers, ready as they would be to suspect in land-measurements some design on their independence. At any rate, Burnes succeeded in mapping the whole of Cutch and part of the northern shores of the Ran and Guzerat to a scale of 4 miles to the inch. I can give my personal testimony to the very great accuracy of this map, and it stood the test of use by the civil and military authorities for fifty years—that is, until it was superseded by the publication of the surveys made by the Government of India. Burnes' great achievement in the making of this map deserves more than a passing reference, for it must not be forgotten that the extent of country surveyed exceeded Wales in area; that it included numerous hilly tracts; that these were frequently thickly covered with dense jungle; moreover, he had to commence operations by instructing his assistants of all classes. Alexander Burnes being by nature an explorer, it was to be expected that he would be fascinated by the Ran and the problem of its formation. During the years he was in Cutch the Ran was his constant study, and while he camped at Lakhpat, with the vast and mysterious region stretching out before him, he wrote his last word on the subject.

Burnes had learnt from the Periplus that in Alexander's time the Ran was navigable; he had learnt from the natives of Cutch that but a few generations before their time certain towns, which are named on the accompanying map—Niruna, 23 miles north-west of Bhuj, Bhitaro, Vingur, Baliari, and Khod—were seaports; also that vessels had been known to be wrecked on Pacham, and that they ran for shelter in heavy weather to the island of Karir. McMurdo, also, had found stones far from the Ran, circular with a hollow centre, such as are used by the natives as anchors for small craft. But most interesting of all the finds was that of a native craft near Wawanya, which, embedded 15 feet in the soil, was exposed on a nullah shifting its course and cutting into the bank where it lay. This vessel was of a type much larger than those used up to within the last 150 years; it had no iron in its construction, the planking being bound together by coir ropes; and generally it corresponded in design to ships known to have been built by the Arabs at a port in the Persian gulf named Omana, some two thousand years ago.

This evidence satisfied Burnes that the area now known as the Ran was at one time a navigable sea, and that the existence of this vast

tract was owing to the "receding of the sea from the south coast of Cutch, and I [Burnes] believe it is a generally received conclusion that there is a depression of its level throughout the globe, though in some places it has risen." McMurdo, and others who followed him, on the other hand, considered the Ran to be an elevated sea-bottom. The years which have passed since the papers and reports of Burnes, McMurdo, and others, have produced a literature on the subject of the Ran and its origin which has been poor in its additions to our knowledge.

Before starting for Cutch, my first aim was naturally the study of every paper and report which I could discover had been written on the Ran. This I found both tedious and laborious; the information was very difficult to get at; but two propositions, however, which emerged, seemed worthy of examination—one being that the Ran was in fact a raised sea-bottom; the other, that it was annually inundated by the sea, when, according to the authors of the papers, the South-West monsoon winds raised the surface-level of the sea in the Gulf of Cutch and in the Khori creek. The highest authority for the latter statement I found to be a paper read before the British Association at the Exeter meeting in 1869.

At first sight the first proposition seemed plausible. Cutch is undoubtedly in a great area of Seïsmic disturbance, and as lately as 1819 suffered from a Tectonic shock, which, besides causing much damage and loss of life, formed a basin-shaped subsidence in the western limits of the Ran, having a well-defined area of several hundred square miles, with a maximum depression of about 20 feet. This area, when filled by an inrush from the Indian ocean through the Khori creek, was known, until some fifty years afterwards it became silted up, as the Sindree lake. Thus the geographical position of Cutch would not preclude the possibility of an uplift of the ocean-bed to form the Ran; but I sought in vain for any evidence of such an upheaval having taken place in at least recent geological times. The islands in the Ran exhibit cliffs of Jurassic formation, which to the north are often very fine, as much in height as 350 to 400 feet. Not infrequently the naked rock appears down to the very edge of the Ran, while in other places the bases of the cliffs are covered by a sloping talus. Here, if anywhere, had an elevation of the sea-bottom taken place, the usual evidences would have been discovered. But there is an entire absence of sea-caves, erosion of the rocks by sea, borings of sea-mollusca restricted to one level, or other evidence of upheaval; nor anywhere along the northern shore of Cutch have raised beaches, gravel terraces, and the like been found. This is equally true of the eastern and northern confines of the Ran, while the even slope of the land surrounding this tract on its eastern and northern confines, and uniform fall of the beds of the rivers and streams which lose themselves in it, point to a period of repose of the Earth's

surface through long geological time. The proposition that the Ran is a raised sea-bottom is thus apparently incapable of proof; in fact, all the attainable evidence points to there having been no noticeable changes in elevation caused by subterranean agency of either the Ran or the countries adjacent to it during recent geological time.

That Cutch is converted into an island by the sea during the prevalence of the South-West monsoon is widely taught and almost universally believed; yet here, again, all obtainable evidence points to this being another popular delusion with regard to the province.

From a glance at the map it will be evident that, for the ocean to encircle Cutch, its waters must enter either by the Gulf of Cutch or through the Khori creek. I examined the first entrance with great care. Between Mallia and Shikarpur is a much-used track crossing 5 miles of the Ran. Natives at both places assured me that water had never been observed to flow inwards from the sea, that when the Ran was flooded at this crossing it attained a maximum depth of only 2 feet, and that the current always set seawards. The water certainly was salt; but the land-water brought down by the rivers is saline, and its salinity would be increased by the solution of salt found *in situ* on the Ran. Between Mallia and Shikarpur I ran two sections with a spirit-level. I found the Ran sloped exactly 6 inches a mile towards Cutch, and that there was nowhere any evidence of scour. I then levelled a 10-mile line at right angles to the first section, 5 miles above and 5 miles below its middle point; the result obtained was a uniform rise from the sea of 6 inches to the mile. I commenced my seaward section at the point which the natives stated the sea reached at high spring tides, under the influence of strong south-westerly winds and in the absence of land-water.

My inland section, like the lower, was run on a bearing, and was stopped on a morning when the mirage rendered the shores of Cutch and Kathiawar invisible, and I stood at the centre of a circular plain of dark-coloured alluvium, delimited by an atmosphere of quivering air. On this occasion I was not alone; but, to appreciate in full the fascination of the Ran, on another day, when the sun was high in the heavens and producing a maximum of atmospheric effect, I walked for some 3 miles, on a compass bearing, into the Ran, leaving the low sandy plains of Kathiawar behind me. On halting, the feeling was one of awful isolation. As before, the horizon was one unbroken circle, the plain on which one stood a perfectly level sheet of black alluvium seamed with desiccation cracks some 3 inches deep by 1 in width, each polygonal cake glistening with salt-crystals. But perhaps even more impressive than the utter absence of life of any kind was the appalling silence: the world seemed dead around one. Had I run this section further, I subsequently ascertained, I should have obtained, at a distance of 50 miles, a rise of 20 feet. This gentle slope of 6 inches to the mile

explains the deposit of silt of such a coarseness as would take place from water moving with a velocity due to that fall; only the very finest comminuted matter would be retained and carried seawards by water moving with so slow a current.

These sections, together with information obtained locally, would be quite sufficient to show that sea-water cannot get round to the north of Cutch from the gulf of that name, but, were any further proof asked for, I would invite an inspection of the narrowest crossing of the Ran—that is, between Wagir and Chorar. Here the Ran is only 1½ mile wide; the surface of the ground is some 40 feet above mean sea-level, and composed of hard sand. I believe that we have here the divide between the deltas of the Luni and the Kathiawar rivers flowing into the Lesser Ran. The only other possible entrance for the sea into the Ran is, as stated above, by the Khori creek. A few words will suffice to show that it does not enter here, for at Lakhpat bunder there is only a depth of a fathom of water at low tide. The tide is stated to rise 6 feet at springs; but the Khori creek shallows rapidly to the north-east, where, at a point 600 yards from the bunder, there is a ford practicable for horsemen and cattle during the whole monsoon. If the Ran was flooded by the ocean, we should have in the break of the monsoon, when it is said to occur, a continuous current of great volume and lasting for many days to flood an area of many thousand square miles; but this does not occur. On the contrary, throughout the year the tides near Lakhpat are perfectly normal. Were any further proof required of the absence of sea-water throughout the year from the Ran, it is furnished by a study of the site of the now silted-up Sindree lake. This lake, as is well known, was formed by an inrush of the sea filling a depression caused by a subsidence following the earthquake of 1819. No sign of this lake now exists, except some pools of brine which are known to be rapidly decreasing in area. Had the site of the lake been regularly visited by sea-water since its formation, these pools, instead of being—as they are—so intensely saline as to be destructive to marine life, would contain water of ordinary sea-water character with living sea organisms. Further, it should be noted that the Sindree lake occupied the lowest ground in the Ran, as it was the only area flooded when the earthquake of 1819 provided, in lowering the level of the bed of the old Khori channel, an access for the sea round the north of Cutch. I believe that, to solve the problem of the formation of the Ran, it must be approached from a fresh point of view altogether, and that the solution is not to be found in Cutch, nor the Ran itself, but on the mainland. I will endeavour to show that the Ran is the delta of the Hakrá, the lost river of Sind.

Until Napier destroyed the power of the Amirs and seized the Indus valley, Sind was closed to Europeans, and for some years after travelling became safe in the delta of the Indus, the arduous labours of the

settlement of the country afforded the few Englishmen engaged on it scant leisure for geographical research. Nor must it be forgotten that for nine months in the year, on account of the great heat, life under canvas is almost intolerable; even in a bungalow in Lower Sind, I have known the temperature in May and June never less than 100°, and the daily maximum 116°. Such villages as there are provide no shelter for Europeans from the savage heat, while the dust-storms last for months and obscure the features of the country. It is not to be wondered at that our knowledge of the lower course of the Indus has been slowly and painfully acquired, nor that it took many years to accurately survey the country from Karáchi to the Luni river.

I am fully aware that I am on ground which has been for years the scene of much controversy when I approach the subject of Alexander's descent of the Indus, and the site of the apex of the delta of that river as he found it. Nor is it necessary, for the purposes of this paper, to do more than state the conclusions arrived at by that great Oriental scholar Major Raverty as to the topography of the Indus delta in the year (325 B.C.) when Alexander departed on his return march to Europe. This much we know he writes in his great work on 'The Mihrán of Sind'—that the drainage of Upper Sind and the Punjab reached the sea by the Mihrán; that this river separated into two branches at Kalari (26° 40′ N. lat., 68° 30′ E. long.), about 40 miles north of Bahmanábád (modern Mansúriyah); and that Alexander must have sailed down it as far as Patala. At Patala, which was at or very near the ancient site of this town, he ordered a citadel to be built and dockyards to be constructed, recognizing it to be a strategical town of great importance. From Patala he had the choice of either of the two great branches into which the river had divided, as an access to the sea, and he explored them both. The sea coast must have been reached by him by the west branch near Debal, the ancient port of Sind, about 15 miles from Tatta: by the east he would have passed through the Samārā lake, where Nearchus subsequently collected his fleet, arriving at the open sea about lat. 25°, a short distance only from the lake. The exact coast-line in Alexander's time between modern Karáchi and the mouth of the Hakrá, and still further eastwards, will probably never be determined, but for the purposes of this paper the 25th parallel may be taken as sufficiently defining it.

So much for the limits of the land some two thousand years ago. A valuable description of the sea washing this coast-line is given in the 'Periplus,' a coast-line from which, it should be noted, the group of islands now known as Cutch was too distant to be visible. The author, after noticing that the Sinthus (or Indus) has seven mouths, proceeds to say, "To the east of the Sinthus you meet with another bay called Eirinos, hitherto unexplored, which has an inclination to the north. There are, in fact, two bays, or rather one divided into two, a larger and a smaller. The sea in both is shallow, with continual eddies, and

eddies in shoal water extending a great way from shore, so that vessels are frequently aground before they come within sight of land, or are caught in the indraft and driven upon the breakers. At the entrance of this gulf a promontory rises to the right, called Baráké, from the point of which the shore takes first a south-east direction, and then winds round to the west, encircling the bay and including the seven islands which lie off Baráké. Vessels which make this cape keep off from the entrance to the gulf to escape the danger; but if they are once embayed beyond the cape, there is no possibility of retreat. The soundings are as fallacious as the other dangers are imminent, for you have one instant an abrupt cast in deep water, and the next you are upon a rocky bottom, so broken and sharp as to chafe the cables carried out to steady the vessel, and finally make them part from the anchor." In this "bay" the Hakrá, through the Shagārā channel, formed its delta. It is of importance to note that the bay named Eirinos was shallow right across to the Cutch islands, and that the "indraft" setting eastwards would to a very considerable extent confine the deposit of Hakrá silt to the north of Cutch.

We cannot describe the gradual growth of the delta, for with the departure of Alexander and his army there followed a period of no less than a thousand years of "splendid isolation" on the part of India as a whole and of this portion of it in particular; but it may safely be assumed that an uninterrupted deposit of silt took place during this millennium. It has been calculated that the undivided Indus brings down 300 cubic feet of mud per second for seven months in the year, of which one half may well have come down the Shagārā channel. From these data it may be inferred that the delta advanced rapidly seaward, with an eastward trend.

Sind was invaded by the Arabs in 712 A.D., and the Arab historians of the conquest of that country furnish reliable information of the growth the delta had by their time attained. To have a correct conception of how far it extended when the Arabs landed in Sind we should draw a line from a few miles south of Debal and Badin towards Wangah, or even much further east towards Nowarkot. I have ventured, after studying the contours, to extend this line as far as Nagar. Thus, during the thousand years of silence which had passed in the history of the delta since the departure of the Greeks the coast-line had advanced as far southwards as a line joining Nagar with Debal.

For many hundreds of years after the Arab conquest of Sind the sea was still navigable, though doubtless shallower than in Alexander's time; and we find this period marked by the founding of a town named Pari Nagar, near the present village of Virāwāh, in Nagar. "To judge by the extent of the buildings and streets, many of which are traceable—the houses having been built of burnt bricks, some of which have since been excavated and used for the present village of Virāwāh—it would

appear to have been a large and flourishing town" (Raikes). The prosperity of this town can only have been due to its being a seaport. On the site of Pari Nagar are the remains of large Jain temples, most of them of white marble. They clearly demonstrate that at the time of their construction—and which, from dates engraved in some of the slabs, was probably in the middle of the eleventh century—the artisans were by no means behind those of after-times in the art of sculpture. This town must have been a port when the hinterland—prior to the periodical transitions of the rivers of Sind—was well watered, and supported a considerable population. Balmir, another town 100 miles north-east of Virāwāh, shows in its ruins similar evidence of wealth and population, and inferentially also of the Luni having been navigable for at least small craft for some centuries. Pari Virāwāh was destroyed by the Emperor's troops from Delhi in about 1226 A.D., but in any case its decline was imminent and inevitable. A great flood in the northern part of the Punjab territory had brought about a rearrangement of the waterways in the delta, for about the beginning of the fourteenth century the Hakrá lost the greater part of its volume, and for some four centuries continued only with some difficulty to be a perennial stream; it finally ceased to be one in A.D. 1739. Before its decline in importance, the river had, with some assistance from the Luni, and to a small extent from the streams in Cutch, silted up the sea-bed between the mainland and the Cutch islands; for although a channel was kept open for three or four centuries longer by the scour of the land-water from Cutch seeking the sea through the Khori creek, and another along the mainland preserved by the Luni, that the intervening area was a marsh (or ran) in A.D. 1361 we learn from the Arab historian who had accompanied the Sultán Firúz Sháh, when in that year he led an expedition into Guzarat. He describes the marsh as extending from the ocean between the provinces of Sind and Guzarat, in length 90 kuroh (157 miles), and breadth 8 to 30 kuroh (14 to 52 miles). It is "such a howling desert," he adds, "that no bird ever flapped its wings over it, not a tree was to be seen, not a blade of grass, not even a miserable noxious weed"—a description of the Ran five centuries ago which will do equally well for to-day.

Thus far I have dealt with the advance of the coast-line immediately to the north of the Cutch islands, and the silting up of the sea area between by the Hakrá and subsidiary streams; now the advance southward of the delta of the Indus west of the 68° 30′ meridian can be rapidly followed.

The ancient town, Debal, 15 miles below Thathah (Tatta), was the first place in that territory attacked by the Arab leader Muhammad early in 93 H. (711 A.D.), a fact recorded by the Arab historian which enables us to fix the position of this portion of the coast-line at the beginning of the eighth century, for Debal was then a seaport. Like

and the Luni water now reaches the Ran as filtered brine; the sea never reaches this vast area, which has now become the dominion of dust-storms.

In the deserts of Thar and Párkar the air is seldom still, and in Cutch, where the rocks are generally remarkably friable, there is seldom a calm day. Though the prevailing wind is west, it blows for ten months in the year also from the south-west and north-west; one month may be allowed for easterly winds, and one month for variable winds. The monsoon sets in generally with great violence from the north-east before it settles in the south-west. In the desert, as in Cutch, a quiet breeze is enough to raise the dust, and a strong wind makes the air so thick with sand that a man fifty paces off would be invisible. Sir Charles Napier, writing from the Hyderabad district in January, when the climatic conditions would be at their best, says, "Our eyes are full of sand, ears full of sand, noses full, mouths full, and teeth grinding sand; enough between our clothes and skin to scour the latter into goldbeater's leaf—one might as well wear a sandpaper shirt. Our shoes are in holes from dryness, and we walk as if we had supplied their places with sand-boxes; our meat is all sand, and on the average every man's teeth have been ground down an eighth of an inch, according to his appetite." As might be expected, Æolian deposits in the Ran are being accumulated with great rapidity under the conditions which obtain. On the northern shores of the Ran, what was open water in the times of the Greeks is now occupied by parallel ranges of sandhills, having their crests from 6 to 8 miles apart, and in height some 50 to 80 feet above the hollows between them. These come right down to the shores of the Ran, on which they are encroaching, and which, it is safe to say, they will some day occupy, burying beneath them the alluvium whose origin I have been endeavouring to trace.

Very great changes within the last eighty years, through the agency of drifting sand, can even now be discerned by comparing Burnes' map of the Ran with the present conditions. Large areas which are shown as of Ran formation on it, and which are so described in contemporary notes on the most used crossings from Cutch to Sind and Nagar, are now areas of firm sand sustaining a scanty vegetation, while the formation of these sandy islands, or "bets" as they are called locally, is going on unceasingly.

The prevailing direction of the winds, and its distance from the deserts of Thar and Párkar, as well as the high state of cultivation of Kathiawar, render the Lesser Ran less liable to dust-storms than the Greater; wind-borne deposits are, accordingly, a less prominent feature of its present condition. Such as occur are in its eastern confines, but the Kathiawar shore is skirted by low hills of drift sand, and there is a well-marked series of dunes extending for 20 miles from Wawanya along the coast of the Gulf of Cutch.

I have throughout this paper adopted the simplest spelling of the name now given to this province. Cutch is, of course, merely a phonetic rendering of the Urdu word, whose nearest transliteration into Roman letters is "Kachchh," which means alluvium brought down by rivers. "Ran" means a marsh. Thus, when we talk of the Ran of Cutch, we say the Marsh of alluvium. It is out of the question that the rocky islands which lay off the mouth of the Hakra could have been called Kachchh at the time of the Greeks, or even for centuries later. It is probable that, as the islands formed part of the ancient province of Saurásthrá or Suráth, so they were named, until their identity was lost in the newly formed land surface connecting them with the mainland.*

After the paper, the CHAIRMAN (Sir T. H. Holdich): I am afraid that the time for discussion is rather short, but Mr. Sivewright has given us one or two very interesting points to think about. About the time that Mr. Sivewright must have been engaged in investigating the conditions of the Ran of Cutch, General Haig, R.E., of the Bombay Survey, issued a small booklet dealing with that very subject, and he, incidentally, pointed out the extraordinary changes that had taken place since ancient times in the course of the Indus. He traced out the old courses of the Indus, and he showed fairly, I think, what the growth of the Indus delta may have been from earliest times. As regards the Ran of Cutch, he distinctly affirms that the sea does occasionally enter the Ran and flood it. After what Mr. Sivewright has told us about the results of his levelling operations and the character of the silt which he examined at the bottom of the Ran, I think there can be no doubt that the Ran is deltaic, and I fancy that the saltness which pervades the water when the Ran is flooded has led people generally to suppose it was sea-water. But the stories of the changes that have taken place in the Ran belong to such ancient history that it is impossible really to say at which epoch these changes may have occurred, or whether they are gradual or sudden. So old are they that even in that ancient epic "The Mahâbhârata," there is a distinct allusion to the drying up of the Ran of Cutch, and the disaster is placed to the credit of the god Varuna. However that may be, it is quite certain that all along that coast, and westward from the Ran to Karrachi, as well as along the Makrán coast, changes have taken place with such rapidity that it is exceedingly dangerous to form any theory as to what the conditions of the country may have been at any particular time. General Haig, I think, has arrived at very fair conclusions as to the outline of the coast in the time of Alexander. I think myself, having gone over the ground, that the indications he gives are tolerably conclusive, but I have myself observed such extraordinary changes in the coast conformation even during the few years on which I was engaged in surveying it that I have long ceased to regard the process of transformation as continuous. I am certain that it has been more or less spasmodic, and that occasionally changes take place with exceeding rapidity, which normally would require very many years. You see that there are three large forces of Nature contending together to produce these changes. First, the wind and current action of the sea, which is most apparent during the south-west monsoon; then the silting action of rivers; and finally there are the periodic and intermittent results of earthquakes, and the action of such forces as Lieut. Headlam has just alluded to, *i.e.* that of mud volcanoes,

* At the same meeting Lieut. Headlam's account of "A New Island in the Bay of Bengal" (*G.J.*, vol. 29, p. 430) was read, and is dealt with in the discussion which follows.

which are even now in active operation over a very considerable extent of the Makrán coast. To show you what may happen in the way of coast alteration, I may remind you that in Karachi harbour alone the mere act of deepening the entrance of the channel into the harbour and carrying the *débris* out into the open sea has led to the silting up of the foreshore opposite Clifton, and so entirely changed the soundings about that part that I understand nowadays it is possible at low tides to walk from the mainland to those well-known islands the Oyster Rocks, between which and the mainland there was once a channel sufficiently deep for steamer traffic. Also at Sonmiáni, in the extreme north-east corner of the Arabian sea, the coast configuration has changed so much, owing chiefly to the detritus which the Purâli brings down, that Sonmiáni itself will soon be high and dry some 4 or 5 miles from the coast. Hitherto it has been a fishing village, but it will not be long before Sonmiáni ceases to be a coast village at all. On the other hand, there is distinct evidence of a great many islands that lie off the coast having disappeared quite recently; and it is curious that, whilst Dr. Keltie has told us of the formation of a new island in the Bay of Bengal, I should have the opportunity of telling you of the disappearance of an island off the coast of Makrán. In the course of the early days of my survey along that coast, there was an island off the western horn of the Bay of Gwattar, which was obviously a chip of the mainland cut off by sea-action. It was a considerable island with formidable cliffs, perhaps half a mile long and some hundred of yards broad, stretching east and west. In the course of one monsoon that island was cut clean in two, and I was able to pass between the two halves in a steam-launch, finding something like 3 or 4 fathoms of water between them. The next year the island had entirely disappeared, and now it forms one of the many shoals which exist along the coast. I only mention this to prove that when you have to deal with forces of Nature so great as those which I have indicated, it is impossible to tell the changes that take place within distinct limits of time. We can but conjecture as to what may have happened even in the Ran of Cutch. Perhaps the gradual extension of the Indus delta and the silting up of the Ran have been the most systematic operation of Nature along that coast, but all the same I think it is very unsafe to venture on any exact definition of what the real state of things was either in the days of Alexander or at any other subsequent date.

Admiral FIELD: I will only just remark that a similar island * appeared in the Tongan group some years ago. It came up to the surface very much in the same way as this one, and disappeared in a short time owing to atmospheric influences and wave-action. Later when I passed it had sunk to the sea-level, and was merely a shoal with the waves breaking over it. Since then it seems to be coming up again, and from the last account there is just the appearance of land showing. In that region there is another, Metis island, about 100 miles to the north, which has been going up and down for the last fifty years. Sometimes it comes up above the surface, but it is simply a reef now. The Metis island was a hard rock—we sounded on it; but the Falcon island was volcanic ash and mud, which atmospheric influence and wave-action soon demolished. In a comparatively short time it was cut down to sea-level, and probably the new island will disappear in the same manner.

Dr. J. W. EVANS: This new island differs in an important respect from those previously recorded. It appears to be only of volcanic origin in the sense that it is connected with the mud volcanoes of the adjoining islands. In these the eruptive force is due to the volatile hydrocarbons of extensive petroleum deposits. Mr. Oldham will, I think, confirm me in saying that there is no evidence of true volcanic activity in the neighbourhood.

* See note on previous page.

Mr. R. D. Oldham said that he had never been nearer the Ran than they were to Edinburgh, but he had read a good deal on the subject, and formed certain conclusions, based on his observations of other analogous districts. As regards the question of whether the Ran was an upraised sea-bed, he thought that Mr. Sivewright had rather slain the slain. The late Dr. Blanford, in his short account of the Ran of Cutch, most distinctly speaks of the deposit as alluvial; and Mr. Wynne, in his memoir of the geology of Cutch, while not denying the possibility of some slight change of level, comes to the same conclusion as Dr. Blanford. In geology three stages have been passed through: the sea was the first of the powers of nature to be recognized—there was a tendency to ascribe everything to it; following on this marine period came the recognition of the power of rivers, and a fresh-water school of geologists arose; finally, we have come to see that wind is an agent as important in shaping the surface of the Earth as either of these two. He had been struck, in reading accounts of the Ran of Cutch, with its similarity to another district, known as the Cutchee, between Jacobabad and Sibi, which is also a featureless tract of mud, flooded in the rainy season, simply because the slope of the surface is so slight that the water cannot run off. This slightness of slope points to the fact that the surface was not formed by water-action; the plain is, in fact, one of the mud deserts commonly found on the edge of the sandy desert, and composed of material carried by the wind, having been sifted out after all the sand has been deposited. These mud deserts are quite a feature in the dry districts of the Earth, and characterized by a deposit which is usually very clayey and always very fine grained, and the surface is almost but not quite level, so that in flood-time the water collects in the hollows; and this, besides the flatness shown by Mr. Sivewright's levelling, is a feature of the Ran of Cutch, for, according to Mr. Wynne, the flooding of the Ran varies from 6 inches to 5 feet up and down as it is crossed.

As regards the question of the advance of the coast-line, he doubted whether Mr. Sivewright had not overestimated it. He was not much impressed with the passage from the 'Periplus' quoted, as these old sailing directions are difficult to understand, and the interpretation of many passages is very doubtful, but he recollected a passage in Tod's 'Rajasthan' where the word *Erinos* used by the Greek writers is noticed as a very much closer approximation to the original form of the word *Aranya* than is our present Ran, and this suggests that the district was, even in Alexander's time, much the same as we know it now. This was in accord with the inherent improbability of so large an accumulation of sediment as is suggested by Mr. Sivewright's map, and he thought that there was probably more land at the time of the Greek intercourse with India and less sea than were represented in the map.

Colonel C. E. Yate: I think there is nothing much that I can say. It is seven or eight and thirty years since I was first on the Ran, and at that time I was more interested in black buck than in scientific research. I approached it from the west through Rahdanpur. About 1872 I again visited the Ran from the north, coming down along the banks of the Luni. There I was engaged in investigating the case of a fight between Sind police and a band of Marwar Dacoits, but that did not lead me into any scientific investigation for future research. My recollection of the Ran is that it was composed of alluvial soil, at any rate on the western side where I saw it. I remember being much struck by the depth to which the feet of the black buck had sunk in the ground when wet in the rainy season, and I thought to myself how easy it must be to run down black buck there with dogs at that season of the year. I thoroughly appreciate all the incidents which Sir Thomas Holdich has told us he has seen on the Mekrán coast. I have seen them all myself; I have looked with interest on the divided island he talked of; I have

also seen the mud volcanoes there, and whether they are due to petroleum action or to what is, I think, a subject of great interest.

Sir ATHELSTANE BAINES: My slight experience of the Ran confirms what the lecturer has said in regard to the character and appearance of the soil, and, also, as to the influence of the monsoon in driving the waters of the gulf on to the southern plain of the Ran. The channel by Wawania is of considerable depth, and would allow the passage of a considerable volume of sea-water. Generally, however, the saltness of the Ran is no doubt attributable to the deposits of salt in the gathering-grounds of the Luni and along the southern border, where large salt works have been established by the Government. Formerly, there must have been closer communication than now between Cutch on the north by Sind and the desert, as the population is almost entirely of northern origin, having migrated from Bikaner and Jodhpur, by Sind or directly south-westward. The desiccation of the upper desert is apparently of comparatively modern date, as the Ghaggar river, now insignificant, once attracted by its irrigational facilities a large agricultural body from the Bhati tract of Rajputana, who have long moved further north. In regard to the direction followed by the encroachments of the desert, I would call attention to the remarkable series of low parallel sand-ridges in the Thar, between Jodhpur and Umarkot. All the system runs directly in the path of the south-west monsoon, and may possibly have interrupted the original course of the rivers flowing into what is now the desert. This would be apparently inconsistent with the suggestion of Mr. Oldham that the encroachment is proceeding from the opposite direction, so I throw it out merely as a non-professional conjecture.

Mr. HEAWOOD: Might I ask for enlightenment on a small point? Mr. Sivewright seems to allude to the account of the seven islands as dating from the time of Alexander. But is there any undoubted work of Arrian's, embodying information of this date, which gives us that account? I know it appears in the 'Periplus.' But commentators are now almost unanimously agreed that this is not the work of Arrian, and dates solely from the first century A.D. Certainly, if the statements of the 'Periplus' could be harmonized with the former geological aspect of the country, this would supply one instance more of the extraordinary accuracy of its author as compared with his contemporaries. It is all the more brought out when we compare his description with that of Ptolemy. Ptolemy gives an island "Heptanesia," with a number of others, but these are all far away from the Gulf of Cutch. He shows a distinct arm of the sea (the "Kanthi Kolpos") running into the land where the Gulf of Cutch really is, but we find here only a single island, which he names Baraké, the name given in the 'Periplus' to the whole gulf. This might perhaps be taken as another argument in favour of the theory that the sea once covered a larger part of this region. There is one point with reference to the map by Purchas that was alluded to in the short abstract of the paper distributed before the meeting. Mr. Sivewright says that Purchas shows five islands in the Gulf of Cutch. Now, his map is merely a rather rough copy of the map Baffin made in 1619, a facsimile of which was given by Mr. Foster in his excellent edition of Roe's Journal, and though there are five islands along the northern shore, there are three others on the southern. I suppose Mr. Sivewright would hardly found an argument on the number of the islands, but if any argument should be based on this, it is necessary to remember there are eight, and not five.

Dr. OWENS: I think a few more levels over the surface of the Ran, giving the relation to sea-level, would help to tell us whether the Ran is a raised sea-bed, or has been formed by silt; I do not know if such levels are available. As bearing on the amount of silt brought down by the Indus and deposited in the Ran, I have made the following rough calculation: Assuming at least 4 feet of water over the surface

when the Arabs invaded Sind in 712, for many hundreds of years after which Mr. Sivewright states the sea was still navigable, and taking the present level as about 10 feet above sea-level on an average, as I infer it to be from the sections, this gives a rise of 14 feet. If, in accordance with Mr. Sivewright's theory, half the Indus silt was deposited in the Ran, it would take about 1400 years to produce such a deposit over the whole area, whereas we have available a period of less than 600 years. This seems to indicate either that the Ran was not formed by deposit alone, or that it was not originally covered entirely by water.

Mr. Sivewright: With regard to the last criticism about a period of 600 years, did not the speaker mean from the invasion of the Arabs to the present time?

Dr. Owen: No; until the last account of the Ran as a desert, 650 years ago, about.

Mr. Sivewright: I can hardly reply to that, because we have no information which would be necessary to take out the quantities as you have calculated. We have not those levels for the Ran. There are a few available along the north-eastern confines, which I have inserted in the map, but there are no other levels available, so far as I know. They have never yet been taken, either of the Greater Ran, the Ran to the north of Cutch, nor of the Lesser. And in the absence of those levels it would be impossible to find out the exact quantity of silt that would be required to fill up the old sea.

The Chairman: I think you will agree with me that we have listened to an interesting and carefully prepared paper by Mr. Sivewright; and we have also had some further interesting information on the subject of the new island. I think it only remains for me to ask you to join in a hearty vote of thanks to Mr. Sivewright for his address.

DR. SVEN HEDIN IN TIBET.

The following are extracts from a letter which has been received from Dr. Sven Hedin, dated "Shigatse, February 20, 1907." After referring to his keen disappointment at being refused permission by the home Government to cross the frontier, and the many marks of sympathy he received from the Viceroy and others in India, he goes on—

"And now, how different does everything look! I have a glorious journey behind me, rich in geographical discoveries of very great importance. I *am* in the heart of Tibet, and I have the future before me.

"I had to try to do my best in spite of all. I had to go on through the whole of Chang-thang in the middle of winter. I organized a first-class caravan with first-class men, and now I have crossed that vast country, and it has been a very beautiful and happy journey. I have lost the whole precious caravan, it is true, but not a single man. Of thirty-six mules (R.200 each) only *one* is left; of fifty-eight ponies only five, and they look more like skeletons, and I have to leave them here. And all the animals were the very best (and dearest) that could be got in Leh. Chang-thang is a difficult country to travel through.

"Anyhow, I have crossed the whole of Tibet diagonally from north-west to south-east, and I have reached Shigatse after a journey which has taken exactly half a year. From causes which you know, I had to

take the way from Eastern Turkestan, at least from the very uncertain point in which Turkestan, Kashmir-Ladak, and Tibet meet. From there I turned eastwards, avoiding so much as possible the regions already visited and mapped by Wellby, de Rhins, Deasy, and Rawling. Rawling's map is very accurate, and by help of it I could easily avoid regions this eminent traveller had already investigated so carefully. To reach the high plateau land, I took a 19,500-feet high pass situated only a few miles east of Chang-lung-jogme, used by Forsyth. As a curiosity, I may add I have a man with me who had accompanied Forsyth some thirty-three years ago, and he is still with me.

"Up in the Ling-zi-thang and Aksai-chin I had a much easier journey than I had expected. Some people told me I should lose at least half the caravan just there, *i.e.* during the first month of the journey. Of course it *was* a hard journey, but nothing like what I was prepared for. Every day we found water—twice with some difficulty, and after long marches, and every day excellent grass. The ground was also excellent, especially since it began to freeze in the autumn. No passes, no hills to talk of, but one of the grandest and most magnificent landscapes I have ever seen—in the north the mighty parallel ranges of the Kwen-lun system; in the south the not less mighty ramifications of the Karakorum system. And between them I kept a comparatively easy course to Lake Lighten, from where I sent back a hired help-caravan of thirty ponies (of which, however, some had died on the way), and my Hindu servants, who could not stand the climate. Thus I sent back the Rajput escort, and for the further journey to the regions where, perhaps, an escort would have been useful, I had not a single man. Except my Ladaki caravan-men who are anything but soldiers, and my Eurasian assistant, I am quite alone here in Shigatse.

"Lake Lighten is one of the greatest and most charming lakes I have seen in Tibet. I crossed it on a couple of lines in my folding boat. As I had never found more than 78 metres' depth in any Tibetan lake, I had now only a 68-metre-long rope with me, and this did not reach the bottom on a couple of points. On the other hand, Pul-tso, of which I made a nice map, and Yeshil-kul, are very shallow. I had the wildest adventures on those lakes; very, *very* narrow escapes. At Pul-tso one of our ponies was hunted by wolves down into the lake and drowned.

"Then I touched Deasy's camp where he had buried a good deal of his provisions and boxes. Nothing was left, since some Tibetan hunters had been there a short time ago; the single thing I found worth taking was Bower's book. However, I was not sorry at all, as we had plenty of everything, and my caravan was still, at this point, in an excellent state. I visited the place chiefly to get a control on my map. Thence we continued east-north-east for some time, crossed Wellby's route, and then crossed the great white patch on the map situated between Bower and de Rhins. Here the real hardships began, and the caravan

melted together day by day. Once we lost ourselves in high snowy mountains with continual snowstorms; here, in two days, I lost eleven mules and a couple of ponies. No grass at all, but water everywhere; sometimes even no yak-dung for the camp-fires. The animals had no provision, and we made very short marches and gave them a day's rest wherever the grass was good. Further south-east we had grass every day, and the country became more favourable. Here and there we passed a new lake, and at least every second day a pass, although these were almost always easy; but even a small augmentation in this tremendous altitude is heavy. One day a big wild yak, which had been wounded near the camp just when I arrived, made a furious attack upon me and my assistant and a footman. He was just at the side of my pony and ready to take it and myself on his horns, when he became aware of the footman, who was running for his life and had just fallen. The yak went over him and hurt him badly, but left us alone. The man is all right now.

"When just on the point that the Ladakis had to carry a part of the luggage, we came across the first signs of man—gold-mines in great number, visited only in summer. Some days later on we found the first nomads, after an isolation of eighty-three days. They were nice and kind in every way, and I bought a number of excellent yaks; they saved our position so far. From here, and the whole long way down to Bogchang-tsanpo, I had always nomad guides, excellent and clever fellows, and we became great friends with all of them. It was no difficulty for me to get points of connection at Bogchang-tsanpo, where I crossed my own route from 1901. To identify the point where I crossed Bower is impossible to say; his map is not sufficiently detailed. On the other hand, I think I followed the shore of the lake de Rhins calls Ammoniac lake. I followed the river some days. A nomad chief here told me he should send word about me to Nantsang-jong at Kyaring-tso (Shansa-jong), and I had nothing against it. Then we continued south. Now the country is difficult, narrow valleys and high passes every day. At Dumbok-tso I passed Christmas; the cold was intense and went down to $-35°$ C. Every day blinding storms from west-south-west, from time to time snowstorms. It was the hardest winter I have been through in Asia. Almost all the men were sick; to ride in such weather is hard work—one gets half dead of cold. Now our last ponies went without loads, as we had the excellent yaks. Very exhausted, we reached the northern shore of Ngangtse-tso, discovered by Nain Singh in 1874. This map contains much valuable information, but it is inaccurate. The form he gives Ngangtse-tso induces me to believe the form of the other central lakes is also wrong on his map. But, anyhow, I admire his work; he was a clever pioneer. He omits whole mountain ranges, *i.e.* the one following the northern shore of Ngangtse-tso; but the worst of all is the way in which he draws the great lines of the

country south of Ngangtse-tso. His Dobo-dobo-tso does not exist at all. He makes the rivers go to the Kyaring-tso in the east; in reality they go to the west, some of them to the Tagrak-tsanpo, the greatest river of Ngangtse-tso, the rest to the Brahmaputra.

"But first I must say a few words about my extraordinary experiences at Ngangtse-tso. Our yaks were now tired, and had to get a good rest. Thus I made head-quarters in the mouth of the valley Kaen, where we made friends with a good many black tents. During this time I undertook a sledge journey of ten days on the ice of the lake, and made a very careful and detailed map of Ngangtse-tso and its depth, which is at its maximum only 10 metres and a few centimetres. It took time to make holes in the ice, which is up to ½ metre thick, although the water is salt. On January 1, when I was away, a troop of horsemen came to the camp to tell us we had to stop; we had no right to travel further, as we had no passport from Lhasa. I returned on the 7th, when the camp was still besieged. Now I was told that the Governor of Nantsang himself would arrive within a few days.

"He came with his escort on January 11, and he was no less than my old friend Hladje Tseng, the same man who had stopped me in 1901 at Nahtsang-tso (Tso-ngombo), with five hundred cavalry. Now he told me again I had to return to the west and north-west, as he would not lose his head again for my sake. I told him my caravan was in a state that I could not go anywhere, but that I had the intention to stay where I was, waiting the reply to a letter I was just going to send to the British agent in Gyangtse.

"Two days later, and for reasons I don't know, he came to my tent again, and told me I could continue my journey south! I believed he had got some special order from Lhasa; but no, it must have been at his own risk. On January 17 I got a big post sent to me from India *viâ* Gyangste and Shigatse, and the postman was clever enough to find me in this labyrinth of mountains and lakes. And so Hladje Tseng returned, leaving me alone in the solitude, and it will be a great puzzle to me always—*Why* did he, the old man, undertake the long winter journey without any result at all? Was it only to see an old friend who had caused him so much trouble once before? I hardly believe it; I don't understand it at all. Then we went on to the south. On January 21 I sent the postman back to Gyangtse. From now we could hire yaks and ponies, and I could travel much quicker than I had expected. My own yaks were left behind.

"The country between Ngangtse-tso and the Tsanpo is extremely complicated. We had to cross several small passes, and five which were 19,000 feet high, with snowstorms and biting cold. This was a hard but very interesting journey. The first high pass is Sela-la, and this is situated in the gigantic mountain range, one of the highest in Asia and on the Earth, which is a watershed between Ngangtse-tso and

Dangrayum-tso on the one hand, and the Brahmaputra on the other. Here I have altogether changed the map, and filled it up with the most complicated labyrinth of rivers and mountains. Between all those high passes we crossed rivers running straight west and falling into the Mytsanpo, that flows south to the Tsanpo, and which is a very great river, even in winter when frozen. Of course, all the other passes are secondary, situated in ramifications from the head range which is situated between and parallel with the Karakorum and the Himalaya. Instead of the white patch here on the map, you will, in future, have to put in an enormous range which must be the continuation of Niuchon-tang-la on the southern shore of Tengri-nor. Sela-la is one of the, geographically speaking, most important passes I have ever crossed, as it marks one point on the position between the plateauland with its self-contained basins and the waters having an outlet to the Indian ocean. The last pass, La-roch, was very easy from the north. From its summit one gets the first magnificent view over the valley of the Tsanpo and the great river itself, winding as a band of silver deep, deep down in the valley. But from here one has to descend some thousand feet down to the great village of Ye, or rather heap of villages and temples. Here we find the first trees. The natives were kind and hospitable, as always. From here I followed the northern bank of Brahmaputra for three days. The last day, from Sta-nagbo, I went down the river in a Tibetan boat, a journey of six hours I shall never forget, in the middle of drifting ice and pilgrims going to the New Year's festival in Tashi-lumpo. I reached Shigatse late on February 9, and made my camp in a garden just on the southern edge of the town, which, by this time, is quite full of pilgrims.

"The Tashi Lama, Panchen Rimpoche, received me with really kingly hospitality. Some lamas and members of the jong were ordered to be at my service in every way. I have been talking with the Great Lama for hours and hours, and I have found him to be one of the most remarkable and charming men I have ever met in life—a man whom one can never forget. Ryder is quite right in what he says of him in his paper in the *Geographical Journal.* I gave him a nice present, and he has overwhelmed me with presents of great value, and whole caravans of provisions for me and my men and animals. The days I don't see him personally, he sends and asks how I am getting on. And I have been present at the festivals in Tashi-lumpo, some of the most picturesque, wild, fantastic, and fascinating I have ever seen. How poor are the lama dances in Ladak in comparison with this! Almost every day, when it is not storm and snow as to-day, I go to the temple to take sketches and photos; I have also taken a couple of *very* good portraits of the Great Lama himself. I have perfect liberty, and can go wherever I like in the great gompa, and all the 3800 lamas are extremely polite and nice to me. The days I have passed here are certainly the most

extraordinary I have experienced in Asia; well, I have been in great dangers before, but *this* is a new world to me.

"Some days ago I had a mysterious visit. Two men from Lhasa came and told me they had been sent by Devasheng and the Amban to Ngangse-tso with an escort to stop me and force me to return to the north. But they had come too late; I was gone. And then in the greatest hurry they followed my route, but reached me here only two days after I had arrived. Their story was correct; they told me, also, how my left yaks and their men were getting on. Now I *was* here, and nobody could help it. But I had no right whatever to be here, and I had to return the way I had arrived. It is like a tale. Without knowing it, I was hunted like a wild animal up in the north, and had my armed persecutors at my heels. They always hoped to reach me, but it was too late to send some other party round to stop me before I reached Shigatse. So far my journey has been the most wonderful experience I have ever been through. All those difficulties which seemed unsurmountable—the winter journey through the whole of Chang-thang, the narrow escape of reaching Shigatse, and a lot of other complicated episodes, which to relate here would carry me too far. Up till now I have 2970 pages of notes for a little more than one year (last journey I had 3800 pages for three years). During the whole journey I have had a feeling of being passive, of being simply the means in a stronger and mightier hand. I go on quietly, surrounded by all sorts of dangers, about which I know little or nothing, and the invisible hand leads me and carries me through everywhere; it is not at all my own merit that everything turns out so nicely.

"I cannot possibly give any detailed scientific description of this long journey through Tibet. The astronomical observations and the meteorological journal, very carefully kept by my assistant, A. Robert, have to be elaborated by specialists. About 200 points have been fixed by boiling-point thermometer; 240 specimens of rocks are collected; the map is in 230 sheets, very detailed. I have drawn about 700 panoramas—five or six of them forming a complete panorama of the whole horizon about 6 or 7 feet long. Some of them are coloured; on the rest I have made notes of the colours. Since we reached nomads all names are inserted on the panoramas, and I always asked questions about roads, climate, wanderings, number of tents, sheep, yaks, etc. The panoramas will give an idea of the whole of the part of Tibet I have crossed, which any description could never do. The profile of the whole crossing will be of great interest; specially it is quite unexpected to find south of the central lakes a mountainous country, which an average is much higher than even North Chang-thang. Thus I found that the high Tibetan plateau continues uninterrupted to the very northern shore of the Tsampo, but in the valley of the river the climate and nature became quite different. Even during the coldest time of the

year one has a feeling of spring and warmth when going down from the edge of the plateau to the valley of the great river. All over Chang-thang, where we met nomads, they said this winter was unusually mild, although I thought $-35°$ C. was quite sufficient even for a man from cold Sweden, and for the excellent and hardy Ladakis.

"I have to pay a tribute of gratitude to my caravan-bashi, Mohamed Tsa. He was with Carey and Dalgleish on their long journey, and with many British travellers in Pamir and Turkestan. He has been travelling for thirty years all over Asia. He was with Dutreuil de Rhins, and was present at his murder; he was with Younghusband to Lhasa, and with Ryder and Rawling on their journey up to Gartok. Now he has kept excellent order in my caravan. Younghusband was kind enough to propose I should take him, and he has done me an excellent service by this, and Patterson, in whose service Mohamed Tsa was at that time, was kind enough to let me have him.

"But my difficulties are not finished yet. The Chinese officials have told me I have no right at all to be here, and I have to return the same way I have come. I do not know at all how this new complication is going to finish. The last news I have is that even the road to Gyangtse is closed to me. It is really hard to be cut off from the single town in Tibet where there is a European, Captain O'Connor, and just when I have only two or three days' travel left, after a journey of half a year, and just when Captain O'Connor has sent me the most charming letters, hoping that I should come and stay with him. I have been looking forward to this visit, and to the great amount of information he would have given me. But I have to cruise between the British, Chinese, and Tibetan governments, and avoid all submarine rocks as much as possible. And the British agent in Gyangtse has, of course, to follow his instructions, and so we are in the position to be quite near to each other, and not to be able to meet."

THE LAO HO IN INNER MONGOLIA.

By the Rev. JOHN HEDLEY.

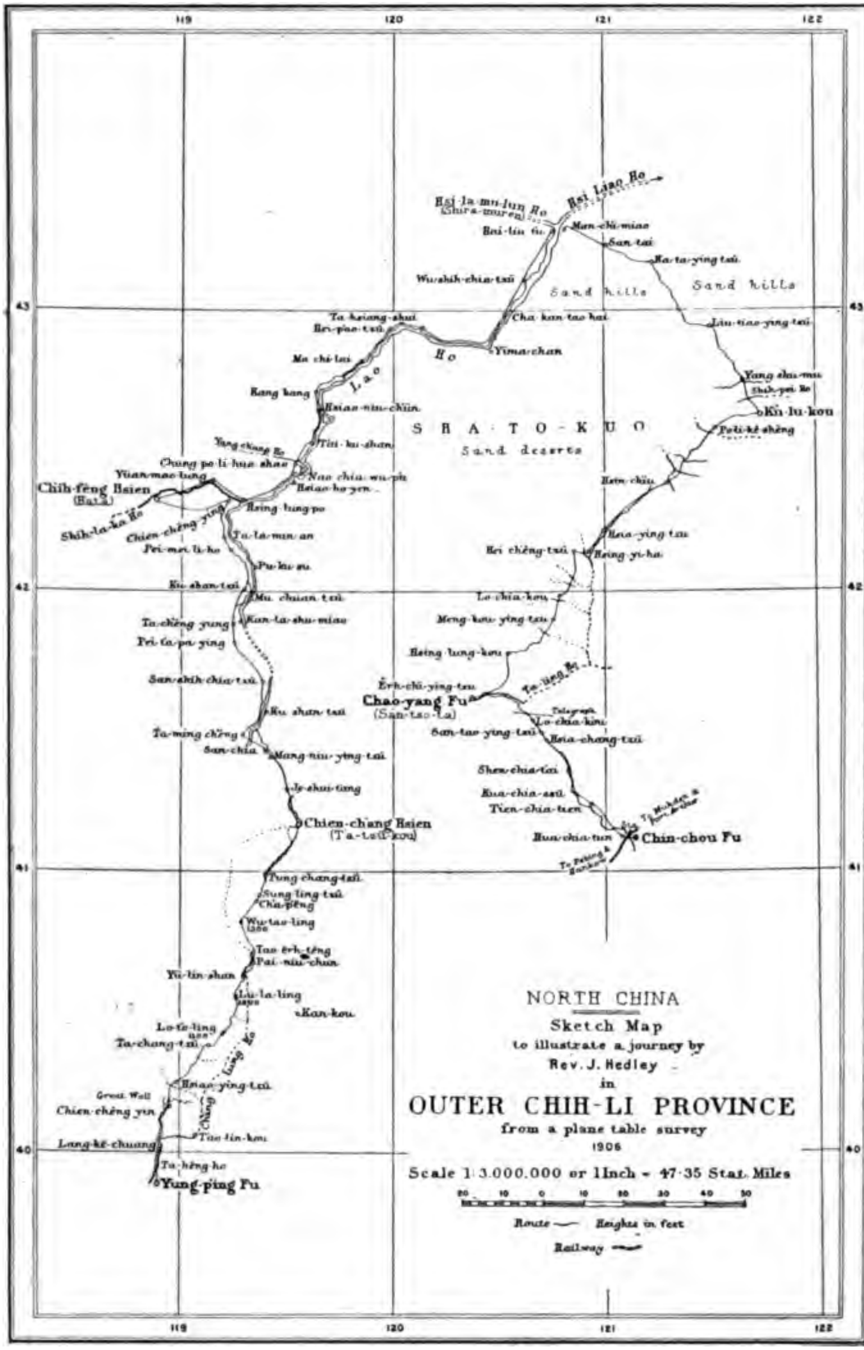
CONSIDERABLE uncertainty prevailing in geographical circles regarding the higher reaches of the Lao Ho river, which empties itself into the sea at Niu-chuang, a trip was recently undertaken by the writer into those regions of Inner Mongolia (or Outer Chihli, if that name is preferred) through which the Lao Ho (Old river) flows, and as the route traversed, so far as is known, has never before been surveyed by any foreigner, a few notes explanatory of the sketch-maps herewith sent may be welcomed by the readers of the *Geographical Journal.*

It is generally known that the Hsi Liao Ho is formed by the Lao Ho and the Shara Muren (Mongolian for Huang Ho, or Yellow river), and

our route covered the distance from within 40 miles of the source of the former stream right up to the junction of the two rivers at Hai-liu-t'u (Earth left by sea), the extreme north-east limit of the Ch'ih-feng district, otherwise known as Hata, but called by the Mongols Wu-lan Hata. The Lao Ho rises in the hilly regions north-west of the city of P'ing-ch'üan Chou (Pa-kou), and flows sluggishly in a north-easterly direction. The first place of any importance it touches is Ta-ming-ch'êng, an ancient and now destroyed city associated with the name of a famous warrior of the tenth century, one Li-k'ê-yung, otherwise known as Li-chin-wang. At this place there still stands a magnificent pagoda, named Ta-ming-t'a (Famous Pagoda), 640 feet high, in excellent condition, the resort of thousands of pious Mongol pilgrims, possibly the finest building of its kind in North China.

It was at this point we first came in touch with the Lao Ho, and from here we slowly and patiently followed its banks for the space of three weeks, until we met with the Shara Muren, and then turned our faces in a south-easterly direction. Near Ta-ming-ch'êng there is a very small stream which has its rise in the hills near the village of Kou-ch'iu. This is known as the Lao Ho Ch'a (Old river fork), and is possibly what was described in the *Journal* some time ago as the Tso-lao Ho (Left Old river). Locally, however, that latter name is unknown, and the stream itself is insignificant, being not more than 6 miles long. It finds its way into the main stream at a village named Pao-ku-lu, just alongside the main road from T'a-tzu-kou (Ch'ien-ch'ang Hsien) to Hata.

From this point until Ch'ien-ch'êng-ying—not to be confounded with the city named above—is reached, a distance of 70 miles, the main stream receives no other tributaries. Just beyond the little town, however, occurs the junction of the Shih-la-ka Ho with the Lao Ho. The name Shih-la-ka Ho is a Chinese transliteration of some Mongol name, whose meaning I could not learn. It is described on the new German map as the Sircha Ho, flowing from the west past the north gate of the city of Hata, and therefore on this stream the city of Hata stands. Further on still—to be exact, 30 miles from Ch'ien-ch'êng-ying—at a village called Chung-po-li-huo-shao (the Glass-burning-fire) the Lao Ho is joined by another small stream named the Yang-ch'ang Ho. Of these two streams the Shih-la-ka Ho is by far the larger and deeper, the bed of the Yang-ch'ang Ho, within a mile of its junction with the Lao Ho, being only 70 feet wide, and the actual water in May only about 15 feet. By what has been spoken of as the Ying-ch'ing Ho must surely be meant this small stream bearing the name of Yang-ch'ang Ho. There is no Ying-ch'ing Ho known in the district near to or east of Hata. The nearest point of the Yang-ch'ang Ho to Hata is some 30 miles due north, but for that statement I have only hearsay, as it was not possible for me to go round that way.


NORTH CHINA
Sketch Map
to illustrate a journey by
Rev. J. Hedley
in
OUTER CHIH-LI PROVINCE
from a plane table survey
1906
Scale 1:3.000.000 or 1 Inch = 47·35 Stat. Miles
Route
Heights in feet
Railway
S H A · T O · K U O
Sand deserts
Sand hills
Lao Ho
Hsi Liao Ho
Hsi-la-mu-lun Ho
(Shira-muren)
Chih-fêng Hsien
Chao-yang Fu
Chin-chou Fu
Chien-ch'ang Hsien
Yung-ping Fu
Ku-lu-kou
Great Wall
Chien-chêng yin
Lang-kê-chuang
Yima-chan
Cha-kan-tao-hai
Man-chi-miao
San-tai
Ta-hsiang-shui
Ma-chi-tai
Kang-kang
Hsiao-niu-chüan
Hsing-lung-kou
Ta-ming chêng
San-chia
Mang-niu-ying-tzü
Tung-chang-tzü
Wu-tao-ling
Lu-la-ling
Ka-kou
Yü-lin-shan
Ta-chang-tzü
Tao-lin-kou
Ta-hêng-ho

The district through which the Lao Ho flows so lazily is known as the Sha-t'o-kuo (Kingdom of Sand-hills). For miles and miles in every direction stretch the sand-deserts. Routes are difficult to trace, and the stranger from afar is compelled to have recourse to the assistance of Mongol guides, courteously supplied by the Mongol princes in authority in the region. Only with the help of these guides can the roads be found or the few settlements reached.

The region naturally is sparsely populated, such Chinese as there are being mostly colonists from Shantung, settled there many generations ago, yet in nowise assimilated to the Mongols among whom they live. As we journeyed northward we heard marvellous tales about the disappearance of the Lao Ho into caverns in the earth which no man had ever explored, but found, on reaching the spot so described, that there was nothing but a very ordinary waterfall, whence arises the name given to the place, viz. Hsiang-shui (Sounding waters).

The most important fact to be noted in connection with the river is the junction with it of the Shara Muren. While the Lao Ho flows ever steadily north-east, the Shara Muren comes into it from the west at right angles, some 2 miles beyond the Chinese village of Hai-liu-t'u. The surprising thing, however, is that at the time of our visit (May 21, 1906) the bed of the Shara Muren was quite dry, though the ground was soft as of recent water. Inquiries elicited the following facts:—

1. There is water flowing from the Shara Muren into the Lao Ho *only* immediately after the frost gives in the early spring. Ten days before our visit the stream had been deep enough to compel foot-passengers to wade across with bare feet, and unless there should be an abnormally heavy rainfall in the summer, there would be no more water there till the early spring of 1907.

2. Some 12 miles west of the junction the Shara Muren turns off into what is known as the T'ai-kan Ho (Great Dry river), and into this stream most of the water diverts. It spreads itself over the plain, and eventually becomes what is known as a "p'ao-tzu," that is, a marsh, of which there are many to be found in the immediate region. These marshes are responsible for absorbing not a little of the water from both the Shara Muren and the Lao Ho. This goes to confirm the statement of Mr. R. T. Turley in the *Journal* for March, 1905, p. 297, that the river "loses much water as it wends its way slowly over the plateau."

3. No other stream joins the Lao Ho north of the Shara Muren until the river enters Manchuria. We were also informed that the river flows steadily north-east for about 70 miles beyond the point we reached, before it turns due south in Manchuria. Also, that the highest point reached by boats on the Liao Ho is to a place named Hsin-ch'êng (New City).

Mr. Turley is in error in his location of the important city of Hata on the sketch-map printed in the *Journal* for March, 1905, p. 298.

The actual distance from this city to the junction of the Shara Muren with the Lao Ho, following the course of the latter river, is 200 miles. The Lao Ho comes no nearer to Hata at any point than 20 miles. That is when it passes a small village named Ta-la-min-an, south of the city.

We found no trace of prehistoric remains in any part of our tramp, though there is an immense tract of country entirely unexplored, embraced in the territory between the Lao Ho on the west and the Manchurian border on the east. It is, however, simply and only a sand-desert, and at present is the haunt of the brigands, who from its secret recesses issue forth on their periodic raids on the unoffending Mongols and unhappy Chinese whose lot is cast there. The brigands, as a rule, confine themselves to horse-stealing or raiding in the market towns, the wealthier business places, and rarely interfere with foreign travellers.

From the confluence we turned in a south-easterly direction to the important business town of K'u-lu-kou, which lies 90 miles north-west of Hsin-min Fu. This town is the headquarters of the Mongol K'u-lün Banner, and a Tibetan lama prince rules over both the banner and the large monastery, with more than a thousand lamas under him. As this busy town of over 10,000 inhabitants has been the subject of discussion in respect of its name, it may be as well to say that, while the official name is as above and signifies "the Common Treasury valley," it is always and everywhere spoken of as "K'u-li-êrh," the two latter words being slurred and pronounced something like "Kulair." It is a very busy place, and quite unique among the towns of North China, since it is built on the sloping sides of low-lying hills, while its main street stands over a deep gully, through which flows a small stream towards the east.

The great road along which we travelled to this town is the principal road that leads from Dolonor or Lama Miao, through the Mongol town of Wu-tan-ch'eng to Mukden. The road leads over the "ts'ao-ti" (grass-land) of the Mongols, where but few are found who speak Chinese, and through many a weary mile of sparsely populated sand-desert. Accommodation and provision on this road are matters of great difficulty, and most caravans carry with them their own water and provisions, camping out on the plains wherever night overtakes them. On this march from Hai-liu-t'u to K'u-lu-kou only two small streams are met. These are the Yang-shu-mu Ho and the Shih-pei Ho. They are crossed at Mongol villages bearing their respective names, and flow in an easterly direction to join the Liao Ho in Manchuria. The former of these is probably that called by Dr. Franke "Yang-sheng-mu" (see *Geographical Journal*, vol. 26, No. 4, p. 426). The name "Yang-shu-mu" means "Poplar tree timber." "Shih-pei" means "Stone tablet."

The maps herewith sent are reductions of a plane-table route-traverse made by an Indian surveyor. I am indebted to Lieut.-Colonel A. W. S. Wingate and Captain F. G. Turner for help and advice.

SURVEYS IN BRITISH AFRICA.

A CONCISE and instructive 'Report on the Surveys and Explorations of British Africa,' brought up to 1906, has been issued by the Colonial Survey Committee, and it must be regarded as a most important contribution towards the advancement of scientific geography.

This report rightly commences by insisting on the necessity for system, method, and uniformity in dealing with Colonial Surveys, and does not omit to demonstrate that the ultimate aim and end of all surveys (including geodetic arc measurements) is the attainment of an accurate and trustworthy map in which every regional and territorial part shall take its proper place and fit squarely in with the continental whole. It is to ensure this result of combining the various local interests of states and territories by demonstrating their geographical interdependence, and promoting concerted action in the many processes of geographical surveying, that the committee has been formed.

The first map of the report illustrates the existing conditions of African map-publication, and it creates a pleasant feeling of surprise at the progress which has already been made in supplying the public with good compilations on geographical scales from such materials as the work of boundary commissions and the sketches of travellers, supplemented by a certain amount of more systematic survey in West Africa, Somaliland, British Central Africa, and Uganda.

Apparently these maps are to be regarded as provisional publications only, to be superseded in due time by the results of the regular surveys of British colonies and protectorates now being carried out by local departments.

Section 2 of the report deals with the progress of frontier delimitation which has furnished the basis of the compilations, but it will be more convenient to refer first to those systematic surveys which are eventually to illustrate the true conditions of African topography.

The backbone of them all, the central artery from which all eventual measurements must radiate, is that great arc of geodetic triangulation which is gradually reaching northward along the meridian of 30° E. long. from south of Natal to Cairo. At the present that chain extends from the south for over 1000 miles; it stretches north of the Zambezi into Rhodesia, and has enveloped Salisbury. "The money (£180,000) for this undertaking, so far, has been found almost entirely by the South African Colonies and the British South African Company," says the report; and some reason for the aloofness of the British Government from the enterprise may be found in the statement that "such an arc serves to determine the shape of the meridian curve, and hence the figure of the Earth, and in this case its scientific value consists, not only in its great length (65° or 4500 miles), but also that it crosses the

equator." The unscientific keeper of the British purse-strings may be apt to consider that the figure of the Earth has been quite sufficiently determined already, and that a little more or less "bulge" at the equator is a matter of no great practical moment. And we must confess that this view of geodetic arc measurement as a scientific abstraction leading to no great practical issue has been to a certain extent supported by the persistence with which its advocators and creators have hitherto ignored its usefulness as a basis for topography and map-making.

We have now the 1905 report of Sir David Gill on the geodetic survey of South Africa, which includes the Rhodesian section of this arc. It is a great contribution to geodetic science; it is a splendid exposition of what may be affected in the way of Earth-measurement with the aid of a 10-inch Repsold theodolite and the Jäderin apparatus for base measurement; but it contains no word of those secondary determinations which, extending from the flanks of the arc on either hand, serve as the framework of that which is the ultimate object to be gained—the accurate topography of Africa. In Rhodesia, which now possesses a survey department of its own, this perhaps is not a matter of such importance as it proved to be further south, where a few such determinations would have been invaluable in the compilation of those never-to-be-forgotten maps which signally failed to assist the progress of military operations. How great their value has been on the Indian frontier is perhaps another story. Under any circumstances, public support is far more likely to be accorded to scientific efforts with a clearly appreciable practical application than to those about which it might be said that "there is no silly nonsense about their being of any use."

The very concise and instructive sketch of the progress of surveys in the various British African territories is only disappointing in one particular. It fails to make any reference to the work done by the local survey departments—in Rhodesia, for instance—and nothing is said about the progress of map-making in foreign states. This, doubtless, is beyond the scope of the Report, but a paragraph or two on this head might have been included with advantage, seeing that the system by which Africa is ultimately to be mapped can only be regarded from an international point of view. Are there any systematic French or German surveys in progress independent of their boundary commissions? Portugal, we know, is busy with compilations, and is probably only waiting for Rhodesia to supply the elements of a start in order to make good geographical headway. Each of the British African dependencies is shortly reviewed in turn, and the public have no longer any excuse for ignorance as to the best maps available. The report of South Africa is not very encouraging. Here we find that "the publication of topographical maps is proceeding in the Cape Colony and in the Orange River Colony. The question of a topographical map of the Transvaal is

still under discussion, and a correspondence is in progress on the subject of a map of Swaziland. A sketch of Basutoland is being carried out. Practically no topographical maps exist of Natal or Zululand, and no such maps are being produced."

Turning now to the work of boundary commissions, one is surprised by the extent of them. The tables appended to the report give a list of thirty-nine, and there is certainly a fortieth ready to take the field. It is to these boundary commissions that the present staff of African map-compilers are chiefly indebted for their material. When such commissions are efficiently organized, properly equipped, and under scientific direction, the surveys which result from their labours are as important in African fields as they are in Asia. Frequently the geographical results outweigh the political advantages to be gained by demarcation; but it certainly appears as if occasionally some doubt might be thrown on the value received in exchange for the time and money expended. We have, for instance, the report of the British Bechuanaland and German South-West Africa before us as a separate publication. It is a work which can only be called amazing. Parallel columns in English and German, with most elaborate tables and figures, set forth the process of determining a part of the boundary of about 450 miles in length, through the desert which separates German from British territory in South-West Africa, during the years intervening between November, 1898, and July, 1903. The remaining part is not completed yet, according to the Colonial Committee report. The proposition was as follows. The boundary defined by agreement, signed on July 1, 1890, at Berlin, was to leave the Orange river at the intersection of that river with the 20th degree of east longitude, thence to be run northward following that meridian to its intersection with the 22nd parallel of south latitude. It was then to follow that parallel to the point of intersection with the 21st degree east longitude. Thence to follow the 21st meridian northward to its intersection with the 18th parallel. Again to follow that parallel to the river Chobe, etc.

As a matter of fact, only half this proposition was actually undertaken, and that half was estimated to cost about £3000 and to take two years in accomplishment. It has taken double that time and more than double that money. Under the circumstances (*i.e.* those of ignorance of the country concerned), it was perhaps difficult to suggest a boundary except on some such artificial lines as those involved by the use of latitude and longitude definitions, although a boundary so defined is the most expensive to demarcate, and the most useless when demarcated. But the great fault in the definition is its want of elasticity. Under the best possible conditions, it is a long, laborious, and most expensive process to determine the exact position of any meridian, to say nothing of demarcating a dead straight line without the assistance of natural ...res, or of maintaining artificial beacons in a desert when once erected.

In this case the demarcation north of the Orange river had to be carried through the Kalahari desert, a track of country deserted and absolutely flat and waterless. The object of demarcation in the midst of an uninhabited desert is best known to the High Commission; but granted that occasional tribal incursions might involve questions of international responsibility, what was the object of adhering to an exact meridian? What would a few hundred yards signify? The difference between running out a line *approximating* to the meridian, and possibly taking advantage here and there of conspicuous natural features (which occur even in a flat desert), and of defining a wholly artificial line with geodetic exactness, is this. In the first case a small party properly equipped for desert work with a 5-inch theodolite and a plane-table, working on a well-tried system, could have done all that was necessary in one favourable season of a few months' duration. In the other case we have the report to show us what was found indispensable. From the initial point on the Orange river (which was well fixed by first-class triangulation) an elaborate geodetic series had to be carried northward to the 22nd parallel—somehow. It could not be carried through the desert, so it had to make a wide *détour* through German territory. From this main series branches were pushed out laterally into the desert to determine as nearly as possible the position of the 20th meridian, and to fix the intersection of the boundary-line with such "tracks" as crossed it. The process by which the extremities of these minor series were connected by straight lines of artificial "beacons" is not stated. The difficulties and delays which ensued were those peculiar to South African surveys, and need not be detailed. The net result is that, after five years' chequered and expensive work, a part of the boundary-line has been determined at a cost out of all proportion to the results gained. These results are—(1) a very useful geodetic series for the Germans, acquired chiefly at our expense; and (2) a boundary for both of us of doubtful utility in so far as it is marked by no natural and unmistakable features. We get no topography. In Africa it seems impossible to associate topography with triangulation. On the whole it appears that the costs of this geodetic process of delimitation might have been applied to better advantage elsewhere.

Incidentally in the report the progress of educating African natives to work as surveyors is referred to, and the results of experiments are given. But it is far too soon to form any just estimate of what the ultimate success of the movement will be. This is a most important question, for it is to native agency that we must look if we are ever to obtain a sound geographical survey of British Africa within reasonable limits of time and cost.

T. H. H.

REVIEWS.

EUROPE.

Lake Balaton.

Resultate der wissenschaftlichen Erforschung des Plattensees, herausgegeben von der Plattensee-Commission der ung. geogr. Gesellsch.' Vol. 1, parts 3, 4, 5, 6; vol. 2, parts 1 and 2; vol. 3, parts 1 to 5. 4to. Atlas, folio: part 1. Vienna, 1897–1906.

Among the monographic studies of single lakes which have appeared during recent years, one of the most comprehensive in its scope is that issued by the Balatonsee-Commission of the Hungarian Geographical Society. The investigation of the great Hungarian lake was begun more than ten years ago, and now the greater part of the work is before us. Large sections of the work are devoted to ethnography, archæology, and even the holiday resorts on the lake have a special section. The purely scientific results are of special interest in comparison with the results of similar researches on the lakes of our own country and of other lands. The Balatonsee or Platten See is a much larger lake than any in Great Britain. In length (about 45 miles) and superficial extent it is better comparable with the Lake of Geneva. It is, however, extremely shallow, having a maximum depth of 33 feet, while the mean depth is only 10 feet; and in consequence of this, some of the physical and biological phenomena differ greatly from those observed in our lakes.

Temperature.—In consequence of the little depth, there is a much greater annual range of temperature than in our greater lakes. Lake Balaton freezes in winter, while our larger lakes never freeze. The extreme range, from 0° to nearly 29° C. is equivalent to nearly 50° Fahr. The annual range in Loch Ness, for instance, is less than 20° Fahr. The maximum summer temperature reaches 84° Fahr., or about 20° higher than the usual summer maximum even in our shallow lakes. Our deeper lakes rarely reach 60° Fahr. at the surface in the open water. Along shallow shores they may go rather higher, where the water is only a few inches deep. The temperature of the water follows much more closely the air-temperature than in our lakes, and sudden and great changes, whether due to wind or the fall of rain, snow, etc., are immediately reflected in the water-temperature, whereas in our lakes sudden changes of air-temperature have hardly any appreciable effect on the temperature of the water, and the only agent which produces change at all rapidly is a strong continuous wind.

Seiches.—The depth being very low relatively to the length, the period of the principal seiche, the uninodal seiche of the whole loch, is very great, according to Von Cholnoky, the greatest known at the time when he writes (1897). The period of the uninodal is from ten to twelve hours. In Loch Ness it is about half an hour. The very marked narrowing of the lake at the peninsula of Tihany divides it into two separate basins. Uninodal seiches of each basin have been observed. The amplitude of the seiches is relatively small compared with other great lakes, though sometimes exceeding anything yet observed in British lakes.

Mirages.—According to Von Cholnoky, mirages are produced when the lowest strata of air are warmer than the upper strata. They are said to be of almost daily occurrence in the Balatonsee, and are seen in the morning. In these mirages objects appear to be lifted up and to float in the air above the surface of the lake, and the images are duplicated by reflection below. Similar mirages are of very common occurrence in Loch Ness. They have the same feature as the Balatonsee mirages, that objects appear to be raised above the lake; but I have never seen

any distinct duplication of the image or heard of such being seen. The most constant feature of the mirage on Loch Ness is the raising of the shore-line at promontories so that they look like overhanging cliffs. As Lake Balaton freezes in winter, the conditions favourable for the production of mirages will be found only in summer and autumn. In Loch Ness the position is reversed, and the mirages are winter phenomena. The deep body of water maintains a high winter temperature (about 43° Fahr.), and, as the air falls to a much lower temperature almost every night, the mirage is found in the morning when the lower strata of air are heated from the loch.

Biology.—It results from the shallowness of the lake that there is no pure plankton, the organisms which constitute the plankton in deeper lakes, though here present, being mingled with numerous littoral and bottom forms. More than one thousand species of plants and animals are noted, the numbers being approximately equal. The fauna is compared with that of the Great Plöner See, the latter having only 254 species, against 580 recorded for the Balaton See. Such comparisons are valueless, unless every class has been thoroughly studied in each lake by specialists. Such figures only indicate the amount of work done, not the actual status of the lakes. All such investigations are incomplete, and in each case some classes are neglected which are studied in others, as the birds are omitted from the Plöner list, while the Balaton naturalists noted seventy-four species. The exhaustive study of certain of the purely microscopic groups, as the Infusoria or the Diatoms, for instance, will swell the lists almost in direct ratio to the time spent upon them. Forel summarizes the biology of the Lake of Geneva, recording 928 organisms, 555 animals, and 373 plants, which have by no means all equal title to be regarded as lacustrine natives.

J. M.

ASIA.

Malay Peninsula.

'Pagan Races of the Malay Peninsula.' By Walter William Skeat, M.A., and Charles Otto Blagden, M.A. In two vols., demy 8vo, pp. 724 and 855. London: Macmillan & Co. 1906. *Price 42s. net. With Map, Plans, and Numerous Illustrations.*

To his former book on 'Malay Magic' Mr. Skeat adds these two large volumes, together comprising nearly 1600 pages, of which no inconsiderable number are in small print. For most of these, as he tells us in his preface, he is responsible, Mr. Blagden's share in the work being mainly confined to the section dealing with the language of the peoples of the peninsula. It may be said at once that the book is not one for general reading, but is rather a non-alphabetical dictionary of the ethnography of the country—a book of reference crammed with facts from all available sources, which is certainly not lacking in information however much its prolixity may daunt the less serious reader.

Mr. Skeat, after giving a preliminary sketch of the geographical and other characters of the Malay peninsula, its fauna and so forth, with the idea that the reader unacquainted with the land should get some conception of the environment of the people of whom he treats, turns at once to the consideration of races and racial affinities. He recognizes three main groups—the Samang, Sakai, and Jakun; the Semang being the Negrito peoples of the peninsula generally, the Sakai the conjectural "Dravido-Australian" group (which, judging only from the abundant photographs illustrating the book, show a singular lack of uniformity of type), and the Jakun, the aboriginal Malayan tribes generally. Mr. Skeat's plan is to take race, religion, language, and the various heads embraced under manners and customs—dress, arts and crafts, hunting, agriculture, and so on—and to pass the three

groups in question successively through the mill of enquiry. Thus we have dress of the Semang followed by dress of the Sakai and dress of the Jakun, and so throughout. Every available authority has been consulted and is quoted or the reference given, so that, though one is confident that very little can have escaped the compiler's observant eye, the feeling that a good deal of pruning might with advantage have been done is no less strong. The system has, however, the merit of enabling any one consulting the book to find the subject he is in search of at once, together with the data for comparison with other tribes.

It would be impossible, within the limits of a short notice, to do justice to the unwearying industry of the two authors, or to give any adequate idea of the immense amount of material here got together. In addition to that of the body of the book, numerous appendices deal with folk-songs, magic, charms, etc., and occupy nearly a hundred pages of the first volume, while a large amount of space is allotted to a consideration of the comb, sumpitan, and quiver decoration, and Vaughan-Stevens' theories concerning the patterns, with regard to many of which, it may be remarked, Mr. Skeat remains unconvinced. Mr. Blagden's labours on the languages of the peninsula occupy a large part of the second volume, and the "Comparative Vocabulary of Aboriginal Dialects" which follows extends to over 260 pages. This is really a provisional dictionary of these tongues, and must have necessitated enormous labour and research. Mr. Blagden's work has led him to the conclusion that there is a typical Semang group of dialects, best represented by the language of the aborigines of Central Kedah, and that this contrasts strongly with a typical Sakai group, of which the best examples are the languages in South Perak and the adjoining parts of Pehang. There is, however, no such good Jakun type. He considers that the Semang and Sakai tongues show two distinct strains of the Mon-Annam element, the one ancient and remote, the other much more recent. The question of the relation between race and language is nevertheless a very complex problem which needs more detailed investigation before any certain conclusion can be arrived at. The hypothesis of a Mon-Kher occupation of the Peninsula is strongly supported by linguistic evidence, and it is suggested by Mr. Blagden that this may have begun about the fifth century A.D., or perhaps earlier.

Enough has been said to show that the book is not only a monument of careful research, but a necessity for every student of the races of the peninsula. In his preface Mr. Skeat claims to have set forth in his two volumes the whole substance of what has been written on these people by dozens of explorers and observers, often in inaccessible or obsolete books and periodicals, and his claim may readily be admitted, with the addition that the facts are marshalled and presented by one who is himself one of the best authorities on the country. The book is furnished with a very large number of photographs of natives, but these form the least satisfactory part of it. Many of them are groups, which are often taken at too great a distance to be of any use in showing the type. Satisfactory heads of good size, taken full-face and profile, are conspicuous by their absence.

F. H. H. G.

AFRICA.

Abyssinia and British East Africa.

'Sport and Travel: Abyssinia and British East Africa.' By Lord Hindlip. *With* 72 *Illustrations* and 2 *Maps.* London: T. Fisher Unwin. 1906.

In this volume Lord Hindlip records his impressions of a visit to Abyssinia in 1902, and of two journeys in British East Africa, the first in 1903, the second in 1905. On the last occasion the traveller was accompanied by Lady Hindlip, and many of the

photographs which illustrate the volume were taken by her. The chief object of the author in all three expeditions was sport, and his journeys added little to geographical knowledge. Lord Hindlip was, however, in unfamiliar if not unknown regions, and his descriptions of the country he passed through are vivid and valuable. He has also notes and comments on the various tribes encountered, which here and there will help the ethnologist to fill up gaps in his notebooks. Though we cannot recommend Lord Hindlip as a trustworthy guide to Abyssinian history, his criticism on the neglect of the British Government to settle the frontier between British East Africa and Abyssinia is perfectly sound, as are also his comments on Menelek's methods of extending his authority in that region. It is also lamentable that Lord Hindlip's offer, in 1902, to the Government to take a qualified surveyor with him to map any part of British East Africa they desired, provided it was a good shooting country, met with so lukewarm a response that the project was abandoned. The description given of the way in which the white settlers are transforming the Kikuyu highlands is most interesting; one sees a colony in the making. The book, though mainly of interest to the sportsman—and we are not here concerned with the ethics of big-game shooting—is of real value to all interested in the development of European colonization in East Africa. There are two excellent sketch-maps by Mr. J. W. Addison, on the scale of 45 miles to an inch.

F. R. C.

The Ivory Coast.

'Dix ans à la Côte d'Ivoire.' By F.-J. Clozel, Governor of the Ivory Coast. *Maps and Illustrations.* Paris: Augustus Challamel. 1906.

Since Captain Binger's remarkable journey from the Niger to the Gulf of Guinea by Kong in 1887–1889, French officials, military and civilian, have devoted much time and energy to the exploration of the hinterland of the Ivory Coast. Among the most active of these explorers has been M. Clozel, the present governor of the colony, whose book we have before us. 'Dix ans à la Côte d'Ivoire' is not an exhaustive monograph of the colony, some western districts being undescribed, while others, namely Baule, Kong, and Bonduku are considered in detail, the chapter on Baule being contributed by M. Th. Tellier. Some fifty pages are given up to a reprint of articles on journeys in the eastern and northern regions undertaken by the author between 1896 and 1905, and there is a general review of the progress made by the colony during that period. There are six appendices, the first giving in twenty pages a highly interesting and valuable summary of the history of the colony; the second, by M. Delafosse, dealing with the ethnography of Baule; the third recording the result of three and a half years' astronomical observations; and the remainder being devoted to an account of the public works, railways, canals, etc., undertaken by the French. Though we fail to get such a comprehensive survey of the country as would be gained by a more scientific treatment of the subject, M. Clozel's method results in eminently readable and informative chapters. While the physical geography receives fairly adequate attention, more interest is displayed in detailing the economic resources of the country and in describing its inhabitants and their history. On this last point there is evidence of considerable research, nor will the reader fail to be struck with the sympathetic attitude displayed by the French officials towards the races under their control. That is one of the reasons of their success in developing their equatorial possessions in Africa. The chief impression left by a perusal of the book is that the prosperity of the country depends on its jungle products, and on the possibility of profitable agriculture and stock-raising in the open lands north of about 8° N. The rivers being unnavigable save by canoe, the wisdom of a policy of railway-building is apparent. The book contains a number of maps and diagrams, besides numerous small-sized illustrations.

The maps give no contours, and the scale on which that of the region of Kong is drawn is not stated. Those for the entire colony are 1 : 4,000,000. F. R. C.

AMERICA.

CENTRAL AMERICA.

'In dem Vulcangebieten Mittelamerikas und Westindiens. Reiseschilderungen und Studien über Vulcanausbrüche der Jahre 1902 bis 1903, ihre geologischen, wirtschaftlichen und socialen Folgen.' Von Dr. Karl Sapper. 8vo. Stuttgart: 1905. 334 pages. 76 *Illustrations*, 5 *Plates*.

This well-written, well-printed, and well-illustrated book is the outcome of a trip, during the winter of 1902–03, by Prof. Sapper, through the volcanic districts of Central America and the West Indies. In Guatemala he was fortunate enough to witness the eruption of Sta. Maria. His first visit to Martinique was interrupted by the attentions of the local police, who took him for a spy, but this was not altogether a misfortune, for, after visiting St. Vincent, he returned to Martinique, and succeeded not only in obtaining a near view of the remarkable spine of Pelé, but in witnessing the descent of one of those "black clouds" which characterized the recent eruptions of Martinique and St. Vincent. The book is divided into four parts. The first is a narrative of the tour, written very much from the point of view of an intelligent tourist; the second and third are devoted to studies of the recent volcanic outbursts of Central America and the Antilles respectively, and the fourth to the social and economic results of the latter. The first and fourth of these parts are those of most general interest, but the other two are each of them excellent summaries of what is known of two remarkable outbursts of volcanic activity. There is a very good account of the black clouds, and their analogy to the snow avalanches of the Alps is dwelt upon. The descent of the ash-laden vapours was entirely due to gravity, they rolled down the slopes with increasing velocity and a well-defined cauliflower-like outer surface, quite similar to the great cloud usually formed where the upward impetus of the mixed vapours and ashes has been exhausted. One characteristic of the Pelean eruptions was that the explosive force was not great enough to drive this cloud high into the air, often it barely rose above the crater lip, but occasionally it was driven up a few hundred feet into the air, whence it rolled down on to the slope of the hill. In the great eruption the temperature of this cloud when it reached St. Pierre was still high enough to soften glass bottles, and it is not to be wondered at that no living thing could survive this hot blast. Not less interesting in its way is the account of the social effects of the devastation produced by these eruptions. In Martinique they seem to have been greater than in St. Vincent, and the account will be read with very different feelings, according to the view taken by the reader of the position and functions of the white man in the tropics. Put briefly, they may be described as a great diminution of the power of the white element of the population, and a corresponding increase of that of the black. R. D. O.

RESEARCHES IN THE ANDES.

In den Hoch-Anden von Ecuador: Chimborazo, Cotopaxi,' etc. Reisen und Studien von Prof. Dr. Hans Meyer. 551 pp. 3 *Maps*, 37 *Plates*, *and* 138 *Cuts*. Berlin: Dietrich Reimer. 1907.

This book is the outcome of a journey to the highlands of Ecuador, made in 1903 by Prof. Meyer for the special purpose of studying the tropical glaciers of South America, and more especially the question of their former extension. His own observations, and those of other travellers, had shown that there was abundant proof of a former extension of the glaciers in Central Africa, to some 3000 feet below their

present limits, but there was no certain information as to how far this was repeated in the only other region where glaciers are known within the tropics. The question is an interesting one from many points of view, but principally from that of the explanation of the Glacial period; if the experience of Central Africa was repeated in South America, it would render any localized explanation—such as a greater altitude—improbable, and also exclude such explanations of the Glacial period as would confine it to a single hemisphere or part thereof. The result of the journey was to show that, as in Africa, the glaciation formerly extended to some 2500 or 3000 feet below the limits of the glaciers still existing, and that in both regions there are traces of a still older and more extensive glaciation, separated from the more recent one by a period of recession of the ice. This is not, however, the whole scope of the work. Being the main object of the journey, the glaciers receive a chapter to themselves, devoted to their former extension, a description of the differences in the outward aspect of glaciers in tropical and temperate latitudes, and a discussion of the peculiar snow-pillars, which are found in tropical and subtropical regions, and known in South America as *nieve de los penitentes*. The rest of the book, apart from the appendices, is devoted to a narrative of the journey, which, with the numerous and fine illustrations, gives a vivid picture of the aspect of the Central Andes of Ecuador. Anything less like the idea of mountain scenery which might be drawn from the Alps or the mountains of Great Britain is hardly conceivable. The impression of a mountain-chain seems wanting, and instead there is an expanse of undulating, semi-desert country, from which rise in isolated grandeur the mighty masses of the great volcanoes, arranged roughly in two parallel bands, but so far separated from each other as to convey no impression of a connected chain. Of these the most interesting is the great cone of Cotopaxi, which Prof. Meyer considers as, taken for all in all, the greatest and most beautiful of all volcanoes, not even excluding Fuji. Here we cannot follow his lead. Of the great beauty of the isolated peak of Cotopaxi his photographs are sufficient evidence, and in its isolation, its form, and the way in which it dominates the whole of the surrounding country and impresses itself on the inhabitants, it strikingly resembles the great mountain of Japan; but if higher, in height above sea-level, it does not rise so high above its base, and if it carries perpetual snow, it lacks the neighbourhood of the sea which laves the base Fujisan. It would be better to recognize these two mountains as peerless, each in its own domain, than to institute a rivalry or attempt a comparison which must be a matter of personal predilection. The illustrations of the book deserve special notice, not only for their technical and artistic excellence, but for the judicious combination of sketches and photographs, and the skill with which they have been selected so as to give an unusually realistic impression of the aspect of the regions travelled through. R. D. O.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

THE FLOW OF GLACIER ICE.

'The Viscous *vs.* the Granular Theory of Glacial Motion.' By Oswin W. Willcox. 8vo, pp. 23. Published by the Author. Long Branch, N.J.: 1906.

This pamphlet of less than a couple of dozen pages has been produced as a reply to the theory of glacier motion advocated by Prof. Chamberlain. The argument is divided into two parts, the second being an intricate quantitative testing of Prof. Chamberlain's theory, through which we need not follow the author; the validity of some of the arguments seems doubtful, but the first part, "Concerning arguments against the capability of ice to behave as a fluid," contains much that, though not new, is none the less true and important, though generally ignored in discussions of the theory of glacier motion. The fact that a glacier moves and

flows just as a very viscous fluid would do is universally recognized, while nothing is more certain than that it is composed of crystalline ice, and at first sight these two facts seem difficult to reconcile. The crystals we are acquainted with in an ordinary way are all hard and rigid; the geologist in his studies becomes familiar with a much larger number of crystalline bodies, but his experience is such as to confirm the notion that solidity and crystalline structure are necessarily connected with each other, and a crystalline mass that is not rigid and brittle is unthinkable to him. The experience of the organic chemist, however, leads to no such notion. He is acquainted with many substances which can readily be deformed while retaining their crystalline structure, and even with some crystalline liquids which, while capable of free flow, not only exhibit double refraction, but will refract light differently in three different directions. The fact is, that there is no sharply defined boundary between the solid and fluid states of matter; before melting-point is reached the plastic yield-point is attained where, given sufficient pressure, it is possible for a solid, even a crystalline solid, to become deformed and flow without either liquefying or losing its crystalline character.

Once this fact is recognized we get rid of all the supposed difficulties in reconciling the known facts of the motion of glaciers with the physical character of glacier ice. Nor does its truth rest only on the general considerations which are adduced by our author, who does not seem to be aware that over fifty years ago Perron found that ice commenced to absorb latent heat at about 2° C. below its melting-point, becoming plastic at the same time. Prof. Heim, recognizing this, found no difficulty in accepting a viscous flow, or in reconciling it with the crystalline structure, of glacial ice, and we have, consequently, no need to go beyond the simple gravitational explanation of the flow of glaciers if we recognize that, while near the surface the ice is essentially a solid, in the interior of the glacier it may behave in many ways as a fluid, in response to the pressures to which it is there exposed.

R. D. O.

Educational.

'Elementary Studies in Geography.' Vol. 1. 'Our own Islands.' By H. J. Mackinder. London: Philip & Son. [1906.] Pp. xv. + 298. *With Maps and Illustrations. Price 2s. 6d., or in two parts, each 1s. 3d.*

'The Oxford Geographies.' Vol. 1, "Preliminary;" vol. 2, "Junior," 2nd edit. By A. J. Herbertson. Oxford: Clarendon Press. 1906. Pp. viii. + 149 and 288. *With Maps. Prices* 1s. 6d. and 2s.

'A Progressive Course of Comparative Geography.' By P. H. L'Estrange. London: Philip & Son. 1906. Pp. xii. + 148. *With Maps and Illustrations. Price* 6s.

These are three new school geographies which merit the attention of all teachers who desire to attain a high standard of up-to-date efficiency, and who consider that class text-books are essential to this end. Each of the three insists on the *human* meaning of geography, and each develops this meaning in the most rational and convincing way, viz. by causes and consequences. As to the geography, pure and simple, contained in them, the names of two of the authors are sufficient guarantee for accuracy and up-to-dateness; nor does Mr. L'Estrange at all fall below the unimpeachable example set in this respect by the Reader and the ex-Reader in Geography to the University of Oxford. Odious comparisons are in a sense avoided, for the books are adapted to different types of schools and scholars. Mr. Mackinder's series appeals to the middle and higher classes of elementary or preparatory schools, and to pupils of from ten to twelve years of age; Dr. Herbertson's to ordinary secondary schools, and to scholars of from twelve years upward; while Mr. L'Estrange's book is suitable for the more luxurious type of public school where

price is not much object, and where boys at, say, thirteen years may begin a systematic course of geography lasting up to their seventeenth or eighteenth year.

To these various ends we have little hesitation in saying that the books are well adapted. To begin with Mr. Mackinder's: three other volumes are promised to complete the series, 'Lands beyond the Channel,' 'Distant Lands,' and 'The British Empire.' They are designed to present a coherent system of teaching, each part depending on the previous parts, and each part providing an advance in subject and method on its immediate predecessor.

What we like more than anything else in the book is the keen pursuit of the human element throughout. Whether the subject is the growth of Bristol and Aberdeen, or the origin of Scotch county towns and counties, or the relics of ancient volcanoes in Britain, or why London is where it is, and not higher up the river or in the middle of England—everything is referred back to its cause in simple and well-chosen language *without unnecessary names.* And then inevitably follow the consequences and their interests to humanity. This is the way to *teach* geography. Boys no longer have abstractions to deal with and academic questions to answer; they are brought face to face with actualities, nay, with their own experiences, for in large classes it is wonderful how many little travellers there are, with powers of acute observation, only waiting the adept teacher to draw them out. Mr. Mackinder, indeed, in his preface, expressly claims that his object is to stimulate oral instruction, not supplant it. Accordingly, he summarizes his work here and there in convenient places, and gives a lead with interrogatory phrases, "Do you remember in the earlier part of the book? . . ." "Think first of, . . . secondly of . . . ," etc. A good teacher will make much of this, though he will undoubtedly gird at the irritating frequency of the inconsiderate phrase, "Let us ask our teacher," or "You should ask your teacher," to do this, that, and the other; in one instance, to tell the form something "from Whitaker's Almanac" (quite a needless advertisement, by the way, and, in the eyes of the form, not particularly complimentary to the teacher), and, in another, even "to buy them something from the Post Office."

Another defect—it seems hypercritical to take stock of defects at all in a book which is so obviously written on the right lines—is, in our judgment, the paucity of *exercises* provided. It is all very well to say that the geography teacher should formulate his own exercises to suit his immediate subject. So he might, and so he often does, but it is undeniable, *crede experto,* that much time is saved if the exercises be ready at hand for the purpose. The teacher of arithmetic would be mightily nonplussed if he had to compose his own "examples;" he is, and has been for years, exceptionally well supplied. Why should not the teacher of geography enjoy equal advantages? And by exercises we do not mean mere examination papers. We mean exercises consecutively numbered (there are scores in Mr. L'Estrange's book —one of its best features), bearing on the map, the picture, or the text, and answerable *thereby* with some little amount of thought and trouble on the part of the student. Incidentally, too, this would relieve Mr. Mackinder's book of its "Reader-like" appearance, for the man who believes in oral teaching likes not geography "Readers." Some exercises, of course, he has given, but most of them are mere measuring operations, and stop just where a useful set might be profitably added. One type, by the way, we draw the line at. The child is told to mark such and such a place on the coloured plate. If this is done in the green tree, what will be done in the dry? Twenty-five per cent. of the class will mark it clumsily in the right place, fifty per cent. will mark it dirtily in the wrong place, and all will regard it as the proper thing to do on all the maps and plates. Verily, the last state of those books will be worse than the first.

The maps, too, are much too good to be rendered liable to this disfigurement. Some of the larger coloured ones, however, are not necessary. They contain nothing but what every good atlas contains, and might tend to discourage the use of the general atlas, which should lie ready to the hand of the pupil at all his geography lessons. But the smaller sketch-maps are just what one wants. They *realize* every paragraph of the text. There is one unfortunate exception on p. 68, where the lakes of Cumbria are portrayed as hills upstanding from a plain which the text describes as "would be flooded (*sic*) if the sea rose 600 feet." The custom of adding explanations and questions at the foot of a map in a school book is excellent. Both Dr. Herbertson and Mr. L'Estrange made good use of it.

The pictures, too, are well chosen, and are genuine illustrations of the text. But a large number are very hazily printed, notably one of Windermere on p. 85, where one of Frith's admirable photographic efforts is quite spoilt. Even this can be used, as they all should be, *i.e.* educationally; question and answer elucidate their meaning, nor should one be passed over—not even the Highlander of p. 95, untypical as he is of the average Highlander of to-day.

The scheme of contents is original. A general introduction, a sort of bird's-eye view of Britain, is followed by five chapters on the North of England, as being not only the central point of the United Kingdom, but also a region of large and simple, yet emphatic topography. Then come Scotland, Ireland, Wales—designedly out of the orthodox order, as Mr. Mackinder believes in visualizing the contrasts of the islands. Lastly the rest of England is taken, and the concluding chapters are devoted to such specialities as London, the railways, place-names.

Mr. Mackinder's style, throughout, aims at clearness and simplicity. His words are well chosen and easy. But he has a tendency now and then to write too much *down* to the children. "Ask your teacher" is one instance; "Some day you must learn the reason of this (rain deposit), but you would not understand it yet" is another. "Why?" says the child, naturally. And as a matter of fact the particular reason (p. 47) could easily be understood by any child who is expected to master the chapter on contours, or the various quotations from Scott and Macaulay. Indeed, the explanation is apparently taken for granted a little further on in at least two places. But this by the way; the teacher who quarrels with the book here will miss a point, by utilizing which, if he be wise, he can at the same time enhance his own importance, flatter the child, and teach him a valuable lesson.

Both Dr. Herbertson's two volumes deal with the whole of the World divided regionally. The order of his subjects—not perhaps of very great importance after the elements of the home country have been assimilated—is curious in one respect. Vol. 2 is orthodox; it begins with the British Isles, and treats them in great detail, using their conditions and phenomena as illustrations for simple geographical generalizations. It then proceeds to the other continents, and ends with America. Vol. 1—the "*preliminary*" vol.—begins with America and *ends with the mother country*—a striking innovation for which the author offers no explanation, nor can we even suspect one. The progressive nature of the course is apparent from the fact that vol. 1 makes the physical, and vol. 2 the economic, side of geography their respective *points d'appui*, though both strenuously emphasize the human element.

In all his work Dr. Herbertson acknowledges the valuable assistance he has had from his wife, who, indeed, has written half of vol. 2 and supervised the whole of this second edition.

It should be noticed that, although, as we stated above, the books in our opinion appeal to secondary schools and scholars over twelve years of age, one of the prefaces seems to claim in addition much younger folk as readers. But, as

we shall have occasion to point out, both subject-matter and diction—particularly diction—are, in our opinion, over the heads of the latter. Nor do the titles "Preliminary" and "Junior" bear their ordinary significance; they refer, as was stated in the first edition of vol. 2, to Preliminary and Junior Examinations, the "Oxford Junior Local" being cited as a type of the latter class.

The books are good—we may say that at once—and well worth the attention which—as is shown by the rapidity with which a second edition has been called for—they have evidently received. The *human* element is always to the fore; the why and the wherefore are never absent, and are as prominent in the treatment of African vegetation as in that of the growth of British towns. The method is, therefore, generally educative. At the same time it is very largely descriptive. There is a tendency here and there to rather too much of the "sheep per acre" and "cattle per acre" style, and—worse than all—there is a great dearth of exercises. But it is in the descriptive quotations and condensed descriptions, which in vol. 1 overload the book, that we particularly find the work hard for young folk. It becomes downright "dry" in places—the very worst thing for the Peter-Pan ages of ten and eleven—and that is why we should not think of beginning either of the volumes with pupils under twelve. Facts, too, are put in such a way that to take the book with a class, the teacher had need be a well-read geographer. He ought to be this always, of course; that he is not, though it may not be his fault, is nevertheless too common a condition to be lost sight of in estimating the practical value of a school geography. This is where we think Mr. Mackinder's book—though we wish to avoid comparisons—is so good; it explains itself everywhere, and even in the hands of a weak geography teacher—a chapter-ahead man, for example—will effect good work. In the hands of such a one Dr. Herbertson's book would be useless.

On the other hand, what we may term the *teaching* sections—and luckily there are many—are admirable. What could be better than this? "Look at Fig. 58" (Dr. Herbertson is writing of the climate of Europe, vol. 2, pp. 103–105), "where the map shows the rainfall in any year in different parts of Europe . . . Compare it with the relief map in Fig. 54; it will be seen that the rainiest regions are, etc. . . . Look at Fig. 59, which shows, etc. . . . Now look at Fig. 60, which shows, etc. . . . We can now divide Europe into the following climatic regions;" and then follow the natural consequences of the causes indicated. This is, of course, as near *oral* teaching as a book can get, and only requires the human voice of the teacher, and the flow of question and answer, to be the real thing. We only wish there was more of it.

Another section—the maps and diagrams—also deserve high commendation. Both volumes are liberally supplied, 72 in one, 166 in the other. Some of the maps, perhaps, are not necessary; it is obviously impossible in a space 5 × 4 inches to show a really clear plan of the chief physical features of Europe or any other continent. This may be certainly left to the "good atlases and wall-maps," which, Dr. Herbertson says, are not to be replaced, but only supplemented by his work. All, however, are instructive. Most of them have been specially prepared, and the others have been specially selected from such well-accredited series as Mackinder's 'Regions of the World.' We could wish that more of them had explanations affixed, or remarks as in Fig. 72, vol. 1, where comparisons are noted between various parts of the map itself as well as with other maps of a similar nature.

Mr. L'Estrange's book is much the most ambitious of the three. In its method of compilation and in its scope it differs essentially from each of the others, for it attempts to provide within its two covers a whole course of geography from the lowest to the highest forms of the school. This is mapped out in the most ingenious

way. Put briefly, the course, or courses, provided are graded in letters and indicated on the maps in colours as follows:—

Divisions of the school.	Portion to be read.	Colour of names on accompanying maps.
Junior school ...	Section A	Brown
Middle school ...	Sections A + B	Brown + blue
Senior school	Sections A + B + C	Brown + blue + red

i.e. the juniors read only that portion of the book printed under the sign "A;" the middle boys read this over again, and in addition some more details under "B"; the seniors take the whole book. The names on the various maps are coloured according to the division in the school. Incidentally, as the most important names naturally come first, and are, therefore, allotted to the early stages, *red* would, we think, have been their more appropriate colour. As it is, the red names, which are the most conspicuous to the eye, are just those which are intrinsically of the least importance.

Each course is calculated to take six terms (two years), and the six separate subjects are (1) the Principles of Geography; (2) the British Isles; (3) Europe; (4) North America and Asia; (5) Central and South America and Africa; (6) the British Empire. Thus a boy who stays two years in the junior department will have "learnt" the geography of the whole world in section A before he begins his career in the lower part of the senior school, which, of course, is an excellent arrangement.

Now, this scheme has one great merit—it is systematically progressive. It is also thoroughly concentric. The boy as he goes up the school is never allowed to forget (on paper) what he has learnt, and he is continually adding to his acquired stock of knowledge.

But the book, as it stands, has one great drawback. The language in section A is far too hard for small children. The author claims that a boy may begin it "in the lowest class." But what will the young hopeful make of the very first page under the (to him) puzzling heading "The Earth's Crust—Igneous Rocks"? He will read in A (his "junior" portion) that "the diameter of this sphere is about 8000 miles, its circumference about 25,000 miles;" that "beneath the surface there must be intense heat, to account for which it is supposed that once there was in space a great mass of heated gaseous particles revolving round a centre, gradually cooling;" that "very rapidly cooled lava assumes a glassy form;" that "if the cooling process is slower, the various constituents have a tendency to form crystals;" and so on, and so on. We think we were within the limits of fair criticism when we suggested thirteen as the minimum age at which the book might be begun. Consequently, to get it through the school will almost necessarily mean "rushing" the later sections.

Apart from this, though the complications of the A, B, and C scheme require mastering carefully, the work is plain sailing. "The aims of the book," says the author, "are, in general, to stimulate the learner's reason rather than to train his memory. . . . In a word, education, not instruction, is the end in view." And we know of no book that, given a good teacher, will better accomplish this end than Mr. L'Estrange's 'Progressive Course.' He uses physical geography to explain political; he traces history back to geography; he, too, insists on the *human* interest of the subject. His maps, notwithstanding the "red," are most educational; they are pretty and clear and bright, and they are almost invariably followed by

"test" maps. The world maps are drawn on Mollweide's equal-area projection, a most excellent provision. The illustrations are good, and, without exception, accompanied by full notes and questions. That a few of the illustrations are printed poorly, with the result that some of the questions partake of the nature of puzzles, does not detract from the general excellence of the whole. There are plenty of diagrams, and, above all, there are scores of exercises. Of the diagrams, we might remark that percentages would have served the purpose as well as actual figures, and lasted much longer. Of the exercises, the pupil is given a map, and he has to find out *from it* the answers to various problems. Nor can any of the exercises be omitted, as much of the text depends on a right solution of these problems.

We fancy that a drawback may be found in the unwieldiness of the book (it measures 11½ × 9 inches, and weighs nearly 3 lbs.); but it should be remembered that it is really a geography and atlas combined. As such it is, at all events, self-contained, though we do not agree with the author when he deprecates the class use of the general atlas. A greater drawback, perhaps, is the omission of an index of text-names. There is a good index of map-names, and no less than three of contents, but none of these helps much if one wishes to refer to some particular item of interest. To look up "Pittsburg," for example, one finds the map whereon the town is printed (though not readily, for the plates are numbered separately, and there are sixty-nine of them, all told, scattered about the book), and that is all. There is nothing left but to search the text in the neighbourhood of the map. It is curious that, with one exception, all these books are deficient in this respect. The exception is Dr. Herbertson's second volume; but neither his first volume nor Mr. Mackinder's offers the slightest approach to an index at the end of the book.

E. R. W.

Distribution and Economics of Petroleum.

'Petroleum.' By Sir Boverton Redwood. Second Edition. 2 vols. London: C. Griffin & Co. 1906. *Maps and Illustrations. Price 45s. net.*

This comprehensive work now appears in its second edition, considerably enlarged and with many new maps. Of the eleven sections and three appendices, comprising 886 pages, we must chiefly refer to the two first sections giving an historical account of the petroleum industry and the geographical and geological occurrence of oil and natural gas. The sections comprising the chemistry, working, and transport of oil are so technical that we can only allude to them in a very brief manner.

To write a comprehensive text-book on such a variety of subjects necessitated the co-operation of workers whose different subjects have been alluded to by Sir Boverton Redwood in his preface. This has resulted in the most masterly work that has been published on the subject, and it is a tribute to the great industry of the author, who is associated with all the most important petroleum undertakings in England, that the work is thoroughly up to date and forms a veritable encyclopædia on the subject of petroleum.

An examination of the frontispiece maps shows petroleum and natural gas distributed over many countries, but the relative importance of the different occurrences as indicated, is seen on referring to the table in Appendix A, p. 839, where the percentage figures of the total output for 1904 are given. From this it appears that the United States and Russia account for 89 per cent., while the Eastern Archipelago, Galicia, and Roumania send in 8 per cent. India, including Burma, Assam, and the Punjaub, produce 1·5 per cent., while Canada and all other countries contribute the remainder. The references to the ancient authors who mentioned oil are of interest, especially that to Plutarch, who states that at Kerkuk, in Mesopotamia, Alexander the Great was much impressed by a gulf of fire which streamed

continually as from an inexhaustible source. Oil and gas occur to-day at the same place, as related by Lieut.-Colonel Maunsell in his paper on the "Petroleum Deposits of Mesopotamia," printed in the *Journal* in 1897 (vol. 9, p. 528).

The history of the Russian and American fields is given at length, while the area of the Russian petroliferous territory, as quoted by Mendaléeff and confirmed by Marvin—14,000 square miles—points to a long continuance of the Russian fields. The area of territory worked on the Apcheran peninsula (Baku) is taken at about 9 square miles. The gradual lowering of the oil-level at Baku, caused by continuous pumping, is of interest.

In 1873	the depth	from surface	was	174	feet.
„ 1880	„	„	„	273	„
„ 1882	„	„	„	350	„
„ 1885	„	„	„	420	„
„ 1889	„	„	„	665	„
„ 1903	„	„	„	1125	„

The enormous development of the use of natural gas in the United States is noticed. The yield in 1902 is quoted as amounting to 205,784,454,333 cubic feet, while one of the gas wells in Ohio yielded 33,000,000 cubic feet per diem with a pressure (open) of 45 lbs. to the square inch. The distances oil and gas are piped is illustrated in tables given in Section VIII. Lengths of from 300 to 400 miles are not uncommon, the mains being 6 to 8 inches in diameter, and being taken in a straight line over hill and valley without regard to level.

Space forbids us to more than mention the other sections. The ancient Chinese practice of drilling salt-wells in Sechuan, described in Section V. and practised from the earliest times, much resembles American methods, and wells from 1000 to 2000 feet in depth are sunk quite commonly. In the chapter on the origin of petroleum the evidence and views of various writers is stated, and the author is careful not to commit himself beyond the opinion that no single theory is of universal application. "Approximation of product is," he says, "consistent with wide variation of the generating factors."

The work is copiously illustrated, and the twelve double-page maps showing the distribution of oil, together with several maps inserted in the text, much facilitate reference to the geographical distribution of oil. The indexing of a vast amount of facts and information has been done in a complete manner, although it is open to question whether the reference to subjects in such blocks of figures is not too cumbersome. Under United States, for example, there are 6½ lines with 38 references to the text, and 52 lines with 370 references to the bibliography, without any indication of the special subjects treated of. The bibliography is alphabetical under authors' names, and is most voluminous, comprising 5904 references, but with no indication of the relative importance of the works referred to. If the publisher could arrange to print after each chapter that portion of the bibliography dealing with the subject treated in the chapter, reference would be facilitated. We put forward the suggestion for consideration in the event of another edition being called for.

H. T. B.

THE MONTHLY RECORD.

THE SOCIETY.

The Annual Awards for 1907 have been bestowed as follows: The Founder's Medal goes to Dr. Francisco Moreno, one of the foremost

scientific geographers of the day, whose extensive explorations and researches in the Patagonian Andes and adjacent parts of South America are well known to readers of the *Journal*. The Patron's Medal is given to Captain Roald Amundsen, an account of whose daring voyage for purposes of magnetic research in the region of the north magnetic pole, leading eventually to the first accomplishment by any vessel of the famous North-West Passage, was delivered by him to the Society during the present session. The Victoria Research Medal is not awarded this year. Of the other awards, the Murchison Grant is given to Captain G. E. Smith, for his efficient surveys in various parts of British East Africa; the Gill Memorial to Mr. C. R. Beazley, for his important work in three volumes on the history of geography during the Middle Ages, entitled 'The Dawn of Modern Geography;' the Back Bequest to Mr. C. E. Moss, for his researches on the 'Geographical Distribution of Vegetation in England,' the valuable results of which have been published by the Society; and, lastly, the Cuthbert Peek Grant is given to Major C. W. Gwynn, for his accurate survey work, carried out under very difficult conditions, in the region of the Blue Nile and the Sudan-Abyssinian frontier.

EUROPE.

Evolution of the River-system of Belgium.—The peculiar character of the river-system of North Belgium, composed of a number of more or less parallel streams all debouching by the single channel of the lower Schelde, near Antwerp, renders it particularly interesting to trace its evolution during recent geological periods, even though a considerable element of uncertainty must enter into any conclusions which may be drawn. This study was commenced a year or two ago by Mr. J. Cornet, the well-known geologist, and it has more recently been carried somewhat further by M. Briquet (*Bull. Soc. Belge de Géologie*, February, 1907). Four distinct stages of development can, M. Briquet points out, be traced since the northward retreat of the Pliocene sea from this region, as a result of the alternation of periods of erosion and deposition. At the outset the surface was furrowed by a series of consequent streams flowing in parallel courses to the north-north-east. But this simple arrangement was soon modified by a series of captures, in which the tendency, so often noticeable in this part of Europe, to a westward shifting of the river courses was operative. It led to the capture of the whole upper basin of the Dendre by the Schelde, and of upper branches of the latter by the Lys. As erosion reached its maximum in accord with the lowering of its base-level, the westward shifting became still more marked, until eventually both the Schelde and all the rivers east of it were deflected along the southern margin of the Waes-Campine plateau, and, uniting with the Lys, found a common outlet to the north-west of Ghent. This conclusion is arrived at by the aid of borings through the Pleistocene deposits which mask the old relief. The third stage was inaugurated by the return of the sea, either over the whole area, or, more probably, into a series of gulfs corresponding to the modern valleys. A vast series of sediments was deposited, forming an even surface sloping gently from south to north. Two outlets for the drainage at first remained—the one in the direction of Ghent, the other in that of Antwerp. The fourth, or existing stage, was brought about by the eventual capture of the western by the eastern system, possibly due to a depression of the bed of the North

sea, which favoured the eroding power of the Antwerp outlet at the expense of that of Ghent. The result has been to carry the drainage to the sea exactly through the very line of elevation which would have seemed likely to divert it westward.

Geography and Economics in the Magdeburg Region.—A first publication of the Magdeburg *Museum für Natur- u. Heimatkunde* investigates the bearing of the geography on the economy of the Magdeburg region. The treatise takes stock of the geographic conditions of the region in respect of origin, orography, hydrography and climate, constitution of soil, cultivation, and accessibility. It thence shows to what extent the territory is fit for settlement, and what are the conditions determining its human economy. A map exhibits, by four successively deeper shades of brown, the varying altitudes of the region from 150 to 500 feet, and distinguishes the localities of stone, of brown coal, and of salt-mines. The influence of the geography on the economy of the region is also illustrated by a map of density of population, ranging from under sixty to over five hundred to the square mile. The region under examination includes the Elbe depression, forming the convex side of an extensive bow; the fertile plain west and south-west of Magdeburg, passing north and north-westwards into a more woodland region; and the districts of brown coal and salt industry in the south and south-west. Politically the region includes the circle of Wanzleben, parts of the circles of Wolmirstedt, Neuhaldensleben, Oschersleben, Aschersleben, etc., with two enclaves west and two east of the Elbe, and in the south a strip of Anhalt territory. Among the 230 communes comprised in the region only five are accounted thinly inhabited. These lie in the Elbe depression, in the region of the overflows of the Elbe and Bode, and in the woodland territory of the sterile land east of the Elbe. Of these, Lödderitz, above the Saale confluence, suffers from overflow of water, and Grünewalde, opposite Schönebeck, has but little ploughland, though excellently manured by the Elbe sediment. Numerous lakes and river-weeds indicate old courses of the Elbe. In the Elbe depression the products of the meadowland frequently exceed those of the ploughland. The nature of the region everywhere allows the easy application of machinery for its exploitation, to the saving of human energy and capital.

The Simplon Pass in History.—This story of the Simplon pass from the earliest times to the present is sketched in an article in the *Mitteilungen* of the Vienna Geographical Society (vol. 49, No. 10). Among other interesting points are the following: In 57 A.D. Lower Valais was conquered by the Romans as far as Sedunum (Sion), which Roman remains distinguish as "second fort." Nor can it be doubtful that the legions needed a second passage over the Alps, and that no other than by the Simplon. In 196 there existed a path, no *via publica*, in the Toccia valley, the construction of which cost 13,600 sestertii, a better road in any case than the paths over "Sempronius," Gries, St. Theodul, and Monte Moro. An inscription at Vogogna records the construction under Septimius Severus of a road from Geneva to Sion, and all along it are traces of settlements—Roman plaster at Vouvry, a milestone dated 305 A.D. at Hermance, etc., attesting how the Simplon pass was a rival to that of Mons Jovis (Great St. Bernard). After the Roman time Bergundians and Franks traversed Valais. The earliest document naming the Simplon, dated 1235, reports a contract of sale by the commander of the Conflans Hospice, witnessed by the "Commander of the Simplon." Down to 1303 the village Simpeln belonged to the Naters family, and afterwards to Sitten (Sion) church. Bishop Raron founded a trading company to render the Simplon road more profitable. The hospice in "Collibus de Monte Simplono" was in the thirteenth century erected by the Knights of St. James. Scandinavians and Icelanders crossed the Simplon to Rome and Jerusalem. In alliance with Bern, Valais subjugated the Savoyards (1475), and the same year the bishops concluded an "everlasting alliance"

with Berne. Thenceforward Valais was a "confederate locality." A document of date 1640 shows how, even during the Thirty Years' War, the post left Geneva every Wednesday, a letter took eight to ten days to reach Milan, and the postage from Lyons to Italy was ten "sols du roy."

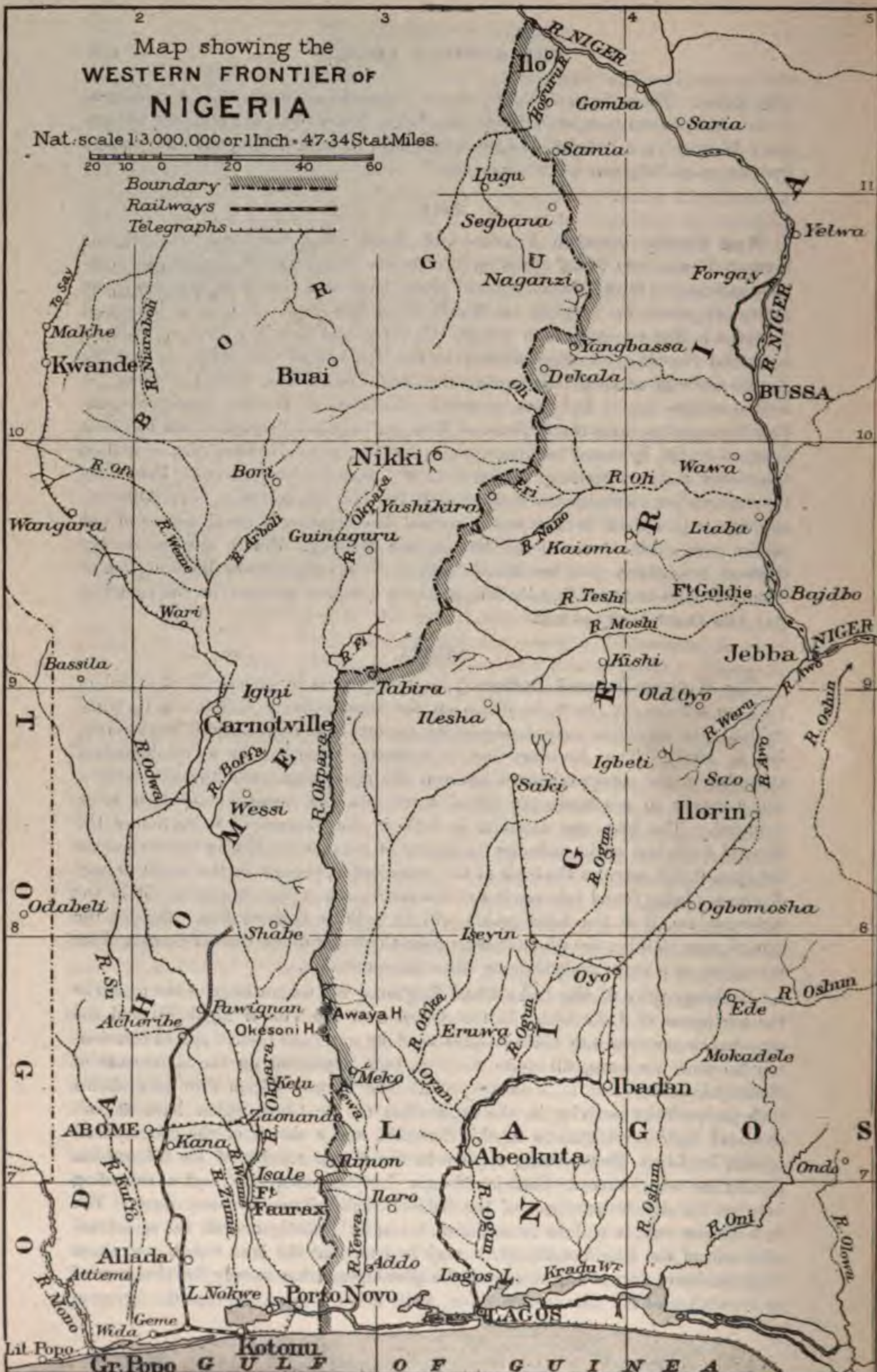
ASIA.

New Treaty between France and Siam.—The territorial arrangements between France and Siam, which, even after the treaty of 1905, never gave complete satisfaction to the French colonial party, have once more been modified by an agreement signed at Bangkok on March 23 of this year. The most important provision is that which gives to France the three provinces of Siem-réap, Battambang, and Sisophon, formerly included in the kingdom of Cambodia; so that the French ambition of once more uniting the ancient Cambodian territories under one administration has at last been gratified. As a set-off for this important gain, France resigns to Siam the territory of Krat and adjacent districts which had been assigned to her by recent treaties, though formerly under Siamese rule, as well as the narrow wedge of territory to the south of Luang Prabang, given to France by the demarcation on the spot as mentioned in the *Journal*, vol. 28, p. 634. Although covering only a small area, it was important as embracing a small section of one of the main routes between the Menam and Mekong. France also waives her rights of jurisdiction over her Asiatic subjects or *protégés* within the kingdom of Siam. It is to be hoped that the long-standing question between the two countries may now be set finally at rest.

AFRICA.

The Nigeria-Dahomé Boundary, as finally fixed by an agreement signed in Paris in October 19, 1906, is shown on the accompanying sketch-map (p. 570), reduced from the official map accompanying the text of the agreement (Treaty Series, No. 5, 1907). The boundary-line is minutely described in a memorandum appended to the notes exchanged between the representatives of the two powers, which appear to constitute the actual agreement, the memorandum itself being unsigned. The map was compiled in 1905 in the Topographical Section of the General Staff, and as it embodies the results of surveys previously carried out on the spot, it will serve as the basis of the delimitation, though in the event of any divergence being found between it and the description of the line contained in the memorandum, it is the latter which will be held as authoritative. Besides the general map showing the whole frontier from the Niger to the Gulf of Guinea, there is another on a larger scale showing the southern section.

Hydrography of the Lake Chad Region.—For a knowledge of the region to the north-east of Lake Chad, in the direction of the Tibesti highlands and the supposed depressions into which some of the lake water has been supposed occasionally to flow, we have, till quite recently, been dependent on the statements of Nachtigal, dating back some thirty years. The French officers who have shown such praiseworthy activity in the exploration of the Chad region have at last extended their investigations in this direction, and a sketch of the geographical results, by Lieut. Freydenberg, appears in the March number of *La Géographie*. During several journeys, Captain Mangin has traversed the region extending between the dry watercourses of the Bahr-el-Ghazal, Egei, Toro, and Jurab. The first of these was, it will be remembered, taken by Nachtigal to be the occasional *déversoir* of the lake, but though it may be true that the lake waters sometimes enter the lower part of the river-bed, the phenomenon has merely the character of an inundation at the time of high water, while it has been proved that the direction


Map showing the
WESTERN FRONTIER OF
NIGERIA
Nat. scale 1:3,000,000 or 1 Inch = 47·34 Stat. Miles.
20 10 0 20 40 60
Boundary
Railways
Telegraphs
R. NIGER
Ilo
Gomba
Saria
Samia
Lugu
Segbana
Yelwa
Forgay
Naganzi
Yangbassa
Dekala
BUSSA
Makhe
Kwande
Buai
Nikki
Wawa
Bori
Yashikira
Wangara
Guinaguru
Liaba
Kaioma
Wari
R. Teshi
Ft. Goldie
Bajibo
R. Moshi
Jebba
Bassila
Kishi
Tabira
Igini
Old Oyo
Carnotville
Ilesha
Igbeti
Sao
Saki
Wessi
Ilorin
Odabeli
Ogbomosha
Shabe
Iseyin
Oyo
Pawignan
Acheribe
Awaya H.
Okesoni H.
Ede
Eruwa
Mokadele
Meko
Ketu
Ibadan
ABOME
Zaonande
Kana
Abeokuta
Isale
Ilimon
Ondo
Ft. Faurax
Ilaro
Allada
Addo
Attieme
Lagos L.
Kradu
L. Nokwe
Porto Novo
LAGOS
Geme
Wida
Lit. Popo
Kotonu
Gr. Popo
GULF OF GUINEA
LAGOS
DAHOMEY
TOGO
BORGU
NIGERIA

of the underground flow, when the river-bed is dry, is certainly *towards* the lake. The rocks collected on the Bahr-el-Ghazal are of a kind not met with in the lower Shari basin, but seem to be derived from the Tibesti highlands. The freshness of the lake water is only relative, and Lieut. Freydenberg attempts to explain the fact that the salinity does not show a progressive increase without having recourse to the supposition of an outlet, though his explanation is not always quite convincing. The Egei, Toro, and Jurab must be regarded as tributaries of the Bahr-el-Ghazal, bringing to the lake the waters of southern Tibesti and Borku. The Egei seems to come from a greater distance than has been supposed, rising in the remnants of a mountain range said to connect Tibesti with the mountains of Agadem. Lieut. Freydenberg has himself traversed the northern part of the Chad basin in various directions. Like other explorers of the lake, he found much of the surface occupied by islands and sandbanks, separated by muddy channels. Except at high water, there seems to be no communication between the northern part of the lake and that into which the Komadugu empties itself, any more than there is between the latter and the portion filled by the Shari. From native information, it seems that there is a periodic minor fluctuation in the level of the lake extending over some twenty years (equally divided into periods of high-water, fall, low water, and rise), as well as an almost complete drying up of its waters at intervals equal to four or five of the shorter periods. According to an old Budduma, who had seen the lake at its last previous minimum, the desiccation was then even more complete than in 1906. He had also seen Overweg at the time of his visit in 1851, the lake being then unusually high.

The Connection between the Benue and Shari Basins.—After the expedition of Captain Lenfant had shown that, in certain years at least, a through water communication may exist from the Logone to the Benue system by way of the Tuburi swamp, two French officers, viz. Naval-Lieut. Audoin, whose survey work on Lake Chad is well known to geographers, and Captain D'Adhémar, of the Colonial Infantry, were commissioned to proceed to the site of the connection and make a thorough study of the hydrographical conditions during the high-water season of 1904. This they did, carrying out at the same time a careful survey of the region, and a summary of the results has appeared in the *Renseignements Coloniaux*, published by the Comité de l'Afrique Française (1906. No. 12). The facts brought to light do not seem to offer great hopes that the waterway will supply an easy communication between the two basins, though it may, no doubt, be capable of utilization. In 1904 the Logone reached its highest level on September 18, and neither then nor subsequently was any through channel of communication established, although the inundation of that year was generally held to be considerable, while it appeared that the maximum level would need to be quite 3 feet higher, in order to open up a channel navigable by boats drawing 0·6 metre (about 2 feet). The surveys of the French officers also failed to reveal any other more favourable line of junction. The examination of the Tuburi marshes likewise showed that no continuous channel, navigable for boats with a draught of 2 feet, existed in 1904; but it is thought probable that in ordinary years such a channel could be opened up, by clearing away the grass and other obstacles, during the months of August, September, and October. The navigation of the Mayo-Kabi is open only during the first two of these months, but during these transport by steam-launches might be possible as far as Trene, which the two officers recommend as the best starting-point for the land route past the section of rapids between the Mayo Kabi and the Tuburi.

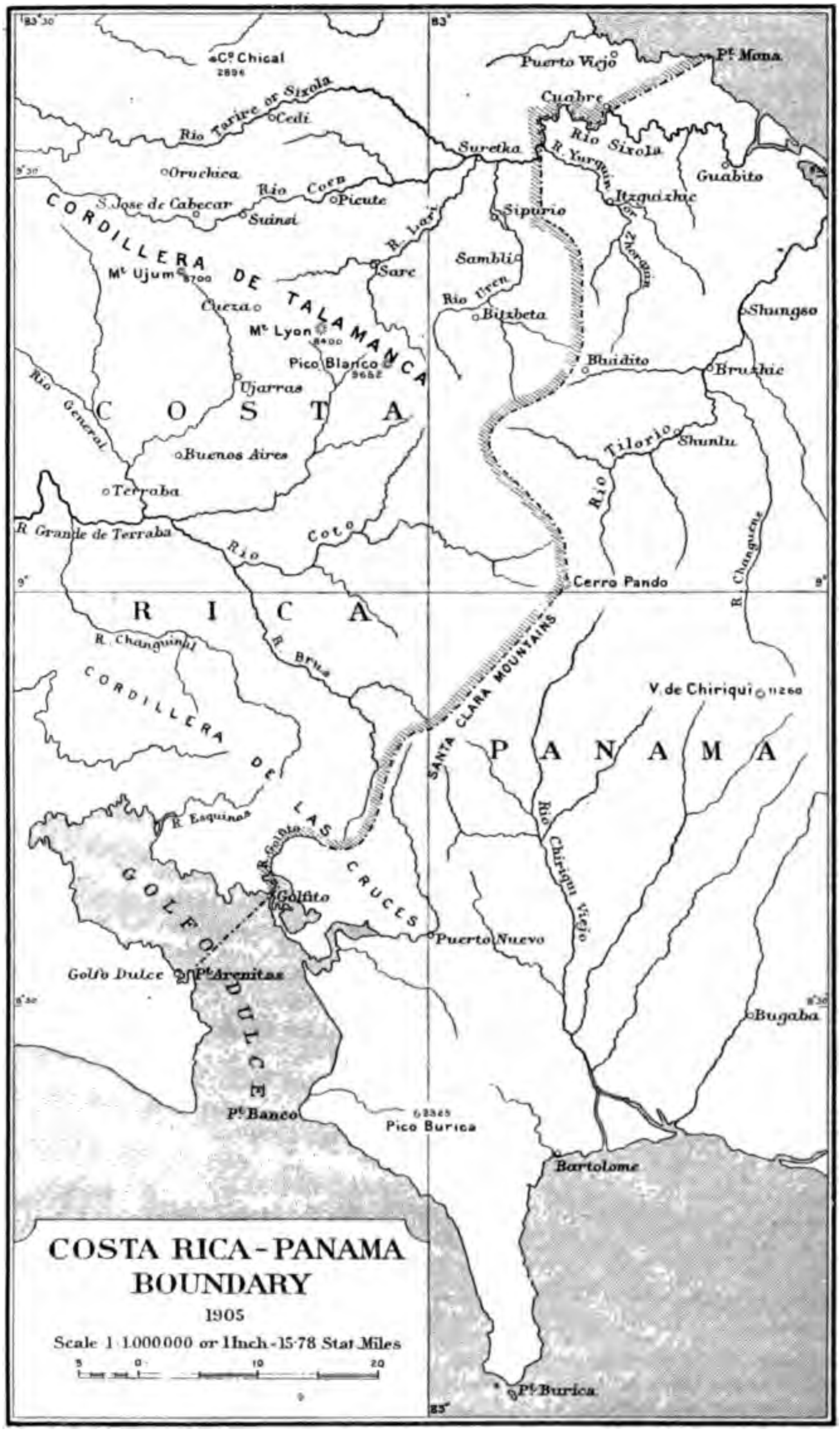
Activity of African Volcanoes.—Attention is called, in a recent number of *Globus* (1907, No. 10), to the fact that the Kamerun mountain must not be regarded as

entirely extinct at the present day. Acting on the reports of the natives, Assessor Meyer made an ascent, in April, 1906, to a spot where steam issued from a small crater, with the accompaniment of sulphurous odours. The crater was reached after crossing an extensive lava-field, but was itself surrounded by low bush. It was a black hole some 15 yards in diameter, with perpendicular walls and an apparent depth of about 160 feet. It is evidently of the nature of a solfatara. The discharge of steam seems to vary, and, according to the natives, reached considerable proportions towards the end of 1905. In the next number of *Globus* (p. 130), a statement made by the White Fathers in the Lake Kivu region is quoted, showing that one of the Kirunga volcanoes (which, is not stated, but the probability seems to point to Kirunga-cha-Namlagira) poured forth glowing lava for three days during 1904, the ruddy tinge in the sky being visible at a distance of fourteen days' march. A new island is said to have made its appearance in Lake Kivu at the same time.

AMERICA.

Glacial Erosion in Alaska.—After adopting, for a time, a cautious attitude in regard to the much-debated question of glacial erosion, Prof. R. S. Tarr has now taken a decided stand among those who believe in the almost unlimited power of glaciers to excavate their beds, given a sufficiency of time in which to work. A study of glacial phenomena in Alaska during his expeditions of the last two summers seems to have removed any hesitation he may formerly have felt in adopting this conclusion. In the *Popular Science Monthly* for February, 1907, Prof. Tarr describes the general features of the fiords of the "Inland Passage," showing that they certainly cannot be due to the normal conditions of stream valley development. In particular, the hanging valleys of this region are so marked a feature as to strike even an ordinary observer, and the photographs which illustrate the paper give many forcible instances of this phenomenon. Prof. Tarr discusses in turn the various hypotheses put forward by those who decline to accept the supposed power of ice to excavate on any large scale, and while allowing that other agencies may have played a subsidiary part, holds that it is to the ice alone that the preponderating *rôle* must be assigned. He points out that the occurrence of hanging valleys on any large scale is always associated with glaciated regions, and considers that the evidence of profound erosion by glaciers is so clear that it seems unnecessary for him to undertake to show *how* the glaciers have performed the work. If, he says, the glaciers smooth, scratch, and pluck the rocks over which they pass, it requires only a sufficiently long continuance of this action to lower valleys to any extent. In the region under discussion he considers that the amount of erosion which must be deduced from the evidence is in places not less than 2000 feet vertically, and that erosion of this magnitude has occurred along hundreds of miles of fiords. For those who doubt the effectiveness of ice-erosion, he recommends a trip through these fiords in the place of a study of the weak termini of small dwindling Alpine glaciers. The writer has certainly made out a strong case for believing that profound erosion may be associated with glaciers; but he has not shown that it is the ice, rather than the sub-glacial streams, that actually accomplishes the work, nor that a large part of the result may not be due to the great efficiency of ice as a transporting agent, whereby the products of rock disintegration are quickly removed instead of remaining on the spot as a protective covering.

The Boundary between Costa Rica and Panama.—Before the separation of the Republic of Panama from that of Colombia, the long-standing boundary question between that country and Costa Rica had been the subject of an award by the President of the French Republic (see *Journal*, vol. **16**, p. 564), the result of which, as interpreted at the time, seemed to be to give to Colombia an important wedge of



COSTA RICA-PANAMA BOUNDARY
1905
Scale 1:1.000.000 or 1 Inch-15·78 Stat Miles
Cº Chical
Puerto Viejo
Pt Mona
Cuabre
Rio Tarire or Sixola
Cedi
Rio Sixola
Suretka
R. Yurquin
Guabito
Oruchica
Rio Coen
Picute
S. Jose de Cabecar
Suinsi
Sipurio
Itzquizhic
CORDILLERA DE TALAMANCA
R. Lari
Mt Ujum
Sarc
Sambli
Cuzza
Rio Uren
Bitzbeta
Shungso
Mt Lyon
Pico Blanco
Bhaidito
Bruzhic
Rio General
Ujarras
COSTA
Tilorio
Shuulu
Buenos Aires
Rio
Terraba
R. Grande de Terraba
Rio Coto
Cerro Pando
R. Changuena
RICA
R. Changuinil
R. Brus
SANTA CLARA MOUNTAINS
V. de Chiriqui
CORDILLERA DE LAS CRUCES
PANAMA
R. Esquinas
R. Golfito
Rio Chiriqui Viejo
GOLFO DULCE
Golfito
Puerto Nuevo
Golfo Dulce
Pt Arenitas
Bugaba
Pt Banco
Pico Burica
Bartolome
Pt Burica

territory previously shown on our maps as part of Costa Rica. But, although the award seemed definitive, questions subsequently arose as to its interpretation, and the matter still remained in more or less uncertainty (*Journal*, vol. **19**, p. 564). Recognizing the altered position arising from the independence of Panama, the two countries concerned opened negotiations with a view to re-defining the frontier in a way that should give satisfaction to both, and the results were embodied in a declaration and two agreements, signed on March 6, 1905, but only ratified on January 25 of this year. The text, both in Spanish and English, is printed in the *Bulletin* of the Bureau of American Republics for January, 1907. It is, perhaps, rather more than ordinarily verbose, and the imperfections of the English translation add to the obscurity of some passages, so that the Spanish version alone should be consulted. The line now fixed runs as follows. As in the award of 1900, it starts from Point Mona on the Atlantic side, but it then strikes south-west for the Sixaola (Tarire) river, which it follows on the left bank to its confluence with the Yurquin or Zhorquin. Hence it runs south to the divide which limits the basin of the Uren (a tributary of the Tarire) on the east, and follows this divide to the main continental water-parting. This last is followed in an east-south-easterly direction to the Cerro Pando, at which point a subsidiary divide is again adopted, the line running between the basins of the Chiriqui Viejo and Coto del Golfo on the east, and the Coto de Terraba and Esquinas on the west, to the source of the small river Golfito, which then becomes the boundary as far as its mouth in the Golfo Dulce. This last (beyond the territorial waters along the coast) is placed in its western part under the exclusive domination of Costa Rica, while the eastern part is dominated by the two republics jointly. The general result is to lay down a more natural line of frontier than was fixed by the award of 1900, and more in accordance with the general usage of maps previous to that date. In the north Costa Rica, and in the south Panama, benefit by the modification of the former award.

Survey of the Northern Frontier of Bolivia.—The survey of the frontier between Bolivia and Brazil in the region of the Acre or Aquiry, as fixed by the treaty of 1903, has been taken in hand, the chief surveyor on the Bolivian Commission being Major P. H. Fawcett, who has as his assistant Mr. Chivers. Writing from the neighbourhood of the upper Aquiry in November and December, 1906, Major Fawcett has communicated to us the results of his work up to that date, and the probable arrangements for completing the survey. He has fixed the positions of several places between the Beni and Aquiry by occultations, and has found that considerable alterations of existing maps will be necessary. Thus the course of the Orton and Tawa-manu (Tahumano) as shown in the map in the *Journal* for May, 1904 (itself based upon the latest Bolivian and Brazilian official maps), will require shifting from 10 to 15 miles to the north. These rivers, as well as the Beni, were surveyed by Major Fawcett on his way to the frontier tract. He has found the work of surveying in this region excessively difficult by reason of the absence of means of communication and labour-supply, as well as of resources of all kinds. Thus not even a tent was procurable, and it was necessary to make one with canvas brought from La Paz. Under these conditions a geodetic survey is impossible, nor is anything desired by the authorities beyond careful exploration checked by astronomical observations, which will probably have to suffice for many years to come. From Bahia, on the upper Aquiry, it was proposed first to ascend that river in canoes, afterwards returning east to map the region of the Abuna, Rapirran, and Iquiry. The following are among the positions so far fixed:—

	Lat. ° ′ ″	Long. ° ′ ″
Riberalta (junction of Beni and Madre de Dios)	10 59 50 S.	66 5 26 W.
Porvenir (Rio Tawa manu)	11 14 11 S.	68 43 10 W.
Bahia (Rio Aquiry)	11 1 0 S.	68 46 47 W.

POLAR REGIONS.

Commander Peary has been granted three years' leave of absence by the United States naval authorities, in order to enable him to renew his untiring endeavours to force his way to the north pole. It is announced that he proposes to start in June of this year.

Proposed Second Belgian Antarctic Expedition.—M. Arçtowski, who, it will be remembered, submitted a project for the systematic exploration of the south polar regions to the recent Congress at Brussels, continues to work with great energy for the organization of a Belgian expedition as a contribution to that object, which was formally approved by a resolution of the Congress. At his request, M. Beernaert, who had presided over the latter, called a meeting of persons qualified to discuss the question, which took place on December 20, and led to the formation of seven local committees for the purpose of carrying on a propaganda in support of the proposed expedition. Both at the first and two subsequent meetings M. Arçtowski's proposals were carefully discussed, and a general approval of the scheme was expressed. The plan put forward is that a voyage of circumnavigation should be made round the south polar area, either within or near the margin of the ice, with the special object of discovering new lands, but without neglecting the necessary scientific observations, which would include a large number of soundings. The starting-point would be the spot where the *Belgica* emerged from the ice during the former expedition, and the route would lead first through the almost unknown quadrant extending thence in a westerly direction to King Edward VII. land. M. Arçtowski, with whom, we believe, the idea of utilizing motor transport in the far south first originated, proposes to attempt this means of advance towards the pole by way of Ross's ice-barrier, eventually wintering in this region. Should this attempt prove unsuccessful, he would spend the first winter in oceanographical work east of New Zealand and the Kermadec group, devoting the next summer to an examination of Wilkes Land. The possibility of extending the work over a third summer would be kept in view, though this would depend on circumstances. Special importance is attached to the definition of the limits of Ross's ice-barrier and of King Edward VII. land.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Voyage of the "Planet."—The concluding portions of the voyage of the surveying ship *Planet* to the scene of its work in the Western Pacific have been no less fruitful of results than those already referred to in the *Journal* (vol. **28**, p. 80; vol. **29**, p. 94). On approaching the Malay archipelago, an important piece of work was performed in the execution of several series of soundings on the outer side of the Sunda islands, the result being to permit of the representation of the sub-oceanic relief with much greater accuracy than has hitherto been the case. The most striking fact brought out is that of the existence of a deep trough, running parallel to the south coast of Java (and possibly extending abreast of Sumatra also), which contains the deepest sounding yet obtained in the whole Indian ocean (7000 metres, or 3828 fathoms). In the third number of *Petermanns Mitteilungen* for 1907, Prof. Supan gives a chart based on information printed in the *Annalen der Hydrographie*, in which he puts forward his own interpretation of the data. He points out that he had some years ago suspected the existence of such a trough, and had indicated it, on the strength of one or two soundings, in his bathymetric chart published in the *Mitteilungen* in 1899. A further fact brought out by the voyage of the *Planet* is the double character of the line of depression, for a second though shallower trough occurs nearer to the coast of Java, separated from the first by a

submarine ridge which appears to represent a south-easterly continuation of that on which the Mentawi group, off the coast of Sumatra, is placed; this too being separated from the larger land-mass by a well-defined trough. As Prof. Supan remarks, this seems to point to folding as a mode of origin of such troughs, another instance of which has lately been brought to light along the line of the Liukiu islands. Detailed reports on the progress of the voyage have continued to appear in the *Annalen der Hydrographie*, a summary of the work accomplished being also given in *Globus* (1907, No. 11, p. 178). After passing through the archipelago by way of Macassar and Amboina, the *Planet* took soundings off the north coast of New Guinea, which was found to fall to the ocean depths even more steeply than the east coast of Madagascar; a depth of 3395 metres, or 1854 fathoms, being obtained at one spot only 9 nautical miles from the land. Other soundings brought to light the features of the plateau, with depths of from 500 to 800 fathoms, from which rise the Matty, Echiquier, Hermit, and Admiralty groups. The drop from these islands to the depths is at first something like 45°. The balloon and kite ascents between Macassar and Matupi in the Bismarck archipelago, showed that, at the time of the north-east monsoon, the lower air-current reaches only to an altitude of 400 to 500 metres (about 1300 to 1600 feet), being followed by a layer of still air of varying thickness, while above this an almost due east wind prevailed up to the greatest heights attained (estimated at 10,000 metres, or about 33,000 feet). In the Indian ocean the kites reached a height of about 16,000 feet, though in the Atlantic the limit was as a rule only about 6600.

Banks off the West Coast of Africa.—It is mentioned in a recent number of the *Annalen der Hydrographie* that the existence of a bank between the mouth of the Senegal and the Cape Verdes was lately brought to light by the German steamer *Santa Rita*. Other banks, rising suddenly from deep water, have been reported from the same part of the ocean within recent years, and seem to form a continuation of the similar series of banks between Gibraltar, Madeira, and the Canaries. One of them, reported by the ship *Birkenhead*, lies at a distance of only 65 nautical miles from that found by the *Santa Rita*.

Causes of the Irregular Distribution of Land and Water on the Globe.—That the absence of land from the greater part of the hemisphere occupied by the Pacific ocean may have been due to the fact that the Moon took its origin from this side of the parent mass is no new idea. It seems, in fact, to have occurred to astronomers comparatively soon after the broad features of the Earth's geography had been revealed by exploration. An attempt has lately been made by Prof. W. H. Pickering, of Harvard University, to examine into the degree of support afforded to the idea by the results of modern science (*Journal of Geology*, No. 1, 1907). This writer arrives at conclusions decidedly favourable to the hypothesis, which supplies an attractively simple explanation of the existing distribution of land and water, though it must necessarily appeal only to those who believe in the relative permanence of the continents and oceans. After a sketch of the general configuration of the Earth's surface, Prof. Pickering shows that, whereas the lighter materials of the Earth's solid crust, which elsewhere form the existing continents, are wanting from the side occupied by the Pacific, there is a fairly close agreement between the density of the Moon and that of the continents, a fact which supports the idea that the former represents a portion of the crust carried away at some remote period in the past. He holds that, as the volume of the Moon is equal to that of a solid with a surface equal to that of all the oceans, and with a depth of 36 miles, this latter figure represents the average thickness of the solid crust at the time of the Moon's origin. After the separation, the portion of the crust left behind was, he thinks, torn in two to form the eastern and western continents,

the marked parallelism between the eastern and western shores of the Atlantic being thus explained. There are several coincidences relating to the position of the central point of the Pacific (in 25° S.), some of which may be more than accidental. One of these is its closeness to the Tropic of Capricorn, for, as the writer points out, the tropics are the lines on a uniform sphere where the direct solar tidal pull acts for the greatest length of time on any particular area of rock. Prof. Pickering does not explain why, if the disrupted portions of the crust, remaining after the catastrophe, "floated on the liquid surface like two large ice-floes," they did not so arrange themselves as to establish a more complete equilibrium. It would seem necessary to suppose that this was effected by a simultaneous rearrangement of the molten materials whereby the denser portions of these were accumulated under the site of the present Pacific ocean. The question of the cause of volcanoes, and their situation near the sea, and where the coast is rising, is discussed in the concluding portion of the paper.

Effects of Ice on Lake-shores.—That a considerable disturbance of the material composing the shores of lakes may result from the action of ice has been recognized for some years, though the subject has not received attention from many observers. Early in 1906 Dr. G. Braun observed the phenomenon on the shores of the Löwentin-See in East Prussia, and was able to secure some photographs, which he has reproduced in a communication printed in the *Schriften der Physik.-ökonom. Gesellschaft* of Königsberg (Jahrg. 47). As explained by Dr. G. K. Gilbert in the fifth annual report of the U.S. Geological Survey, the action of the ice may be due to the filling up of cracks formed in it during severe cold, followed by expansion under a sudden rise of temperature. This process seems to have occurred in the case of the Löwentin lake. The resulting pressure on the shores formed an embankment from 18 inches to over 3 feet high all round the lake, its form varying somewhat according as the shore was composed of sand or other material. The remains of a former embankment of similar character were also noticed. Dr. Braun points out that some benefit may accrue from the protection thus afforded to the neighbouring country against inundation and the action of the waves. A somewhat similar phenomenon, though in this case due to the forcing of the ice on shore by a strong wind, was recently noticed on the Pang-gong lake by Prof. Ellsworth Huntington (*ante*, p. 456), who illustrates it in one of his photographs.

GENERAL.

Mountain Sickness.—Dr. T. G. Longstaff, whose recent ascents in the Himalayas were described in the February *Journal*, has discussed the question of mountain sickness and its probable causes in a pamphlet of fifty-six pages (London: Spottiswood & Co., 1906). He approaches the subject first and foremost from the standpoint of the practical mountaineer, and has brought together in a handy form the experiences of a number of the best-known climbers, in addition to his own. At the same time he treats briefly of the chief physiological aspects of the question, and has reinforced his own conclusions by a study of the important researches of Zuntz and others in this direction. One of the most important points brought out by recent experience is the fact that there seems no such thing as "acclimatization" to low atmospheric pressure, the evidence all indicating that the power to withstand the effects of a rarefied atmosphere is rather lessened than increased by a prolonged stay at high altitudes, the condition of first importance being that the climber should be in the best possible state of physical fitness at the time of making the ascent. This explains the fact that the climbers who have beaten the record of late years have as a rule suffered far less from the effects of rarefied air than many of their predecessors at much lower altitudes, having been as a

rule men of exceptional physique, and in the best possible training. As regards the causes of the symptoms experienced, there is no reason to suppose that, in itself, diminished pressure has any physiological effect, although there may be subsidiary atmospheric conditions (increased diathermancy, stagnation of the air over snow-fields, increased light action, and so forth) which may play their part; and the great difference in the experiences of mountaineers in different regions forbids us to put aside the possible effects of local conditions. But the lessened supply of oxygen is evidently an important factor, at least at altitudes above 19,000 feet or thereabout. The varying intensity of the symptoms in the case of different climbers can be explained in part by the varying degrees in which they are able to make up for the deficiency of oxygen by an increase in the volume of air respired, this varying, of course, greatly in the individual even under normal conditions. Dr. Longstaff lays great stress on the similarity of many of the symptoms to those of ordinary fatigue. Mountain ascents entail an amount of work which is perhaps not always recognized, while Zuntz and others have held that, even apart from the amount of work performed, there is on mountains a greater consumption of oxygen and a more rapid production of fatigue. The maintenance of a proper supply of oxygen and the avoidance of undue fatigue are therefore the most important points to be kept in mind.

New Facts about W. J. Burchell.—A lecture delivered by Prof. E. B. Poulton before the British Association at Cape Town in 1905, and now published in revised form (London, 1907), takes stock of the work, and adds some valuable particulars to the scanty details known of the life, of this pioneer of South African exploration, whose services have hitherto hardly met with due recognition. The explorer's birthday was July 23, but the *year* of his birth still remains uncertain, though in all probability it was 1782. He was educated at Raleigh House Academy, Mitcham. As the main key to Burchell's life, the present publication shows how, cruelly mocked when in immediate prospect of domestic happiness, the highly sensitive yet resourceful man threw himself, for consolation, on the cultivation of the scientific interest already well developed in him. But for the fatal blow struck at his private interest, the world would have had less of Burchell's scientific service. The explorer's grand-nephew has Burchell's original African journal written between May 24 and September 2, 1812. As the two published volumes reach only to August 3, 1812, one month of the lost records has thus been recovered. Besides this, a large mass of valuable material has been unearthed. The manuscript journal of Burchell's three years of African travel after September 2, 1812, and of the whole of his Brazilian journey (1825 to 1830), are, however, still missing. Prof. Poulton calls attention to a number of Burchell's scientific intuitions clearly on the track whereon later Darwin reached the goal—such as the protective device of organisms through accommodation of form and colour to surroundings, or the armament of juicy vegetables with hard thorns in an arid land.

Approaching Geographical Congresses.—The Sixth Italian Geographical Congress falls to be held during the present year, according to the arrangement by which it meets once in three years. The Fifth Congress, that of 1904, assembled at Naples, and before its close Venice was chosen as the place of meeting in 1907. The date of the meeting will be from May 26 to 31, and so far as can be judged from the programmes already distributed, the proceedings will follow the course usual to such assemblies. The annual meeting of German geographers, known as the "Geographentag," will be held this year at Nürnberg from May 21 to 25, so that the two meetings just avoid clashing with each other.

CORRESPONDENCE.

Heights of African Lakes.

The Sports Club, St. James's Square, S.W., March 30, 1907.

REFERRING to discussion on heights of African lakes in March issue of R.G.S. *Journal*, p. 324, the phrase "if you take the monthly reading and strike an average you cannot depend upon accuracy," should read "*unless* you take the monthly reading."

B. WHITEHOUSE.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1906-1907.

Tenth Meeting, March 25, 1907. DOUGLAS W. FRESHFIELD, Esq., Vice-President, in the Chair.

ELECTIONS.—*Frederick Bower Alcock, M.A.; Joachin Catramby; Arthur Herbert Duggan; Davies T. Hart; Theo. W. Kassner; Dr. A. M. Lindsay; Comte Meredyth de Miremont; Johan Carl Wilhelm Petersen; Warburton Pike; Rev. Wm. Coleman Piercy, M.A.; Rev. John J. Pool; Rev. H. Brooke Robinson; Walter Roberts; Edgar Joseph Rowbotham; J. Foster Stackhouse; George H. Storck; Harold Blake Taylor; Captain Francis A. Thatcher; Ernest Charles Thomas; John Willard; James Windham; Herbert Young, M.A.*

The paper read was:—

"Photographic Report of a Journey through the Highlands of Zarafshan." By W. Rickmer Rickmers.

After the paper there was an exhibition, by means of the lantern, of Mr. Borisoff's paintings of Arctic scenery in Novaya Zemlya and Northern Siberia.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Belgium—Phytogeography. *B.S.R. Belge G.* **30** (1906): 237-282. **Bruyne.**
Contribution à l'étude phytogéographique de la zone maritime belge. Par C. de Bruyne. *With Illustrations.*

France—Charente-Inférieure. **Pawlowski.**
B. de G. hist. et descriptive **20** (1906): 217-236.
Les transformations du littoral français. L'île d'Oléron à travers les âges, d'après la géologie, la cartographie et l'histoire. Par Auguste Pawlowski.

France—Gascony. *B. de G. hist. et descriptive* **20** (1905): 183-212. **Buffault.**
La marche envahissante des dunes de Gascogne avant leur fixation. Par Pierre Buffault.

France—Hautes-Alpes. *La G., B.S.G. Paris* **14** (1906): 1-12. **Martin.**
L'ancien cañon de la Blache et les vallées mortes du Gapençais. Par David Martin. *With Sections.*

France—Landes. *B. de G. hist. et descriptive* **20** (1905): 213-216. **Duffart.**
État actuel de la question des transformations anciennes et modernes du littoral gascon, de la formation récente et du comblement des lacs landais. Par Charles Duffart.

France—Lorraine. *B.S.G. Com. Havre* **23** (1906): 5-27. **Ardouin-Dumazet.**
La Frontière Lorraine. Par — Ardouin-Dumazet.

France—Orography. *C.R.A. Sc.* **143** (1906): 307-310. **Jourdy.**
Esquisse tectonique du sol de la France. Note de E. Jourdy.

Germany—Baltic Coasts. **Kaiser.**
Land- und Seewinde an der Deutschen Ostseeküste. Inaugural-Dissertation . . . von Max Kaiser. Halle a. S., 1906. Size 10 × 7½, pp. 22. *Maps and Diagrams. Presented by the Author.*

Germany—Bavaria. *Sitzungsb. A.W. München* (1906): 297-350. **Endrös.**
Die Seeschwankungen (Seiches) des Chiemsees. Von Anton Endrös. *With Map and Diagrams.*

Germany—Bavaria. *Deutsche Rundschau* **28** (1906): 481-495. **Trampler.**
Die Donau von Passau bis Linz. Von R. Trampler. *With Map and Illustrations.*

Germany—East Prussia. **Braun.**
Die Gruppe der Legiener Seen. Von Dr. Gustav Braun. (From the *Berichte des Fischerei-Vereins für die Provinz Ostpreussen*, 30 Jahrgang, 1905-1906, No. 6.) Königsberg i. Pr., 1906. Size 11 × 9, pp. [2]. *Map. Presented by the Author.*

Germany—Harz. *M.V.E. Halle* **30** (1906): 13 69. **Wüstenhagen.**
Beiträge zur Siedelungskunde des Ostharzes. Von Heinrich Wüstenhagen.

Germany—North Sea Coast. *Globus* **90** (1906): 124-126. **Hinrichsen.**
Die Landverteilung auf den Halligen. Kulturhistoriche Skizze von Hinrichsen.

Germany—Prussia. **Proot.**
Vacantie-excursie voor geografen door Zeven-gebergte en Eifel. Door Jo. M. Proot. (Overgedrukt uit het *Tijdschrift voor Geschiedenis, Land- en Volkenkunde*, uitgave van P. Noordhoff, te Groningen.) Size 9½ × 6½, pp. 16.

Germany—Prussian Saxony. *M.V.E. Halle* **30** (1906): 1-12. **Langer**
Die Grenze der Bistümer Verden und Halberstadt von der Elbe bis zur Ohre. Von Julius Langer.

Germany—Rhine Basin. **Schulz.**
Entwickelungsgeschichte der gegenwärtigen phanerogamen Flora und Pflanzendecke der Oberrheinischen Tiefebene und ihrer Umgebung. Von Dr. August Schulz. (*Forschungen deutschen Landes- und Volksk.* **16** (1906): 166-286.) *With Maps.*

Germany—Rugen. *Sitzb. K. Preuss. A.W. Berlin* (1906): 618-627. **Deecke.**
Der Strelasund und Rügen. Eine tektonische Studie. Von Prof. Dr. W. Deecke.
See note in the March number, p. 343.

Hungary—Meteorology. *Meteorologische Z.* **23** (1906): 358-362. **Hegyfoky.**
Die Schwankung der jährlichen Regenmenge in Ungarn. Von J. Hegyfoky.

Iceland—Glaciers. **Rabot.**
Les variations des glaciers de l'Islande méridionale de 1893–1894 à 1903–1904, d'après la nouvelle carte d'Islande. Par Charles Rabot. (Sonder-Abdruck aus der *Zeitschrift für Gletscherkunde*, Band I., 1906.) [Berlin, 1906.] Size 9½ × 7, pp. [7]. *Presented by the Author.*

Italy—Lakes. **Magrini.**
Dr. Giovanni Piero Magrini. Contributo allo studio dei Laghi Lapisini. (Estratto dalle Memorie delle Societa Geografica Italiana, vol. 12, 1905.) Roma, 1906. Size 9 × 6, pp. 42. *Maps, Sections, and Illustrations. Presented by the Author.*

Italy—Modena. *Riv. G. Italiana* 7 (1906): 425–431. **Govi.**
Appunti su alcune salse e fontane ardenti della provincia di Modena. Nota di Silvio Govi. *With Sketch-maps.*

Italy—Vesuvius. *J. of Geology* 14 (1906): 636–655. **Hobbs.**
The grand eruption of Vesuvius in 1906. By W. H. Hobbs. *With Sketch-maps and Illustrations.*

Italy—Vesuvius. *Naturw. Wochenschrift.* 21 (1906): 561–565, 577–581. **Jackel.**
Bilder von der letzten Eruption des Vesuvs. Von Prof. Dr. O. Jackel. *With Sketch-map, Plates, and Illustrations.*

Mediterranean—Cyprus. **Thompson.**
The Flora of Cyprus. By Harold Stuart Thompson. (Reprinted from the *Journal of Botany* for August, September, and October, 1906.) Size 8½ × 5½, pp. 24. *Presented by the Author.*

Norway and Sweden—Flora. **Andersson.**
Die Entwickelungsgeschichte der skandinavischen Flora. Von Dr. Gunnar Andersson. (Abdruck aus den "Résultats scientifiques du Congrès international de Botanique," Wien, 1905.) Jena, 1906. Size 11 × 7½, pp. [54]. *Maps and Illustrations. Presented by the Author.*

Russia—Murman Coast. **Breitfuss.**
Aperçu sur l'Expédition Scientifique pour l'exploration des Pêcheries de la Côte Mourmane, et Résumé des Résultats acquis pendant la période de 1898 à 1905. Par Dr. L. L. Breitfuss. Marseilles, 1906. Size 11 × 8½, pp. 48. *Illustrations.*

Servia. *G.Z.* 12 (1906): 507–519. **Vujević.**
Siedlungen der serbischen Länder. Von Paul Vujević.
Analysis of Dr. Cvijić's important work, published in Servian.

Sweden—Handbook. ———
Sweden. A Short Handbook on Sweden's History, Industries, Social Systems, Sport, Art, Scenery, etc. Edited by the Swedish Tourist Traffic Society. Stockholm, 1906. Size 7 × 4½, pp. 178. *Map and Illustrations. Two copies, presented.*

Sweden—Snow. **Westman.**
Arkiv f. Matematik, Svenska Vetenskapsak. 3 (1906): No. 3, pp. 32.
Sur la couverture de neige de la Suède centrale et septentrionale. Par J. Westman.

Switzerland—Bernese Oberland. **Coolidge.**
Les Colonies Vallaisannes de l'Oberland Bernois. Par W. A. B. Coolidge. (Extrait du "Blätter f. bernische Geschichte" pour 1906.) Size 9 × 6½, pp. 16. *Presented by the Author.*

Switzerland—Cartography. *Le Globe: Mem. S.G. Genève* 45 (1906): 37–58. **Lochmann.**
De la cartographie en Suisse (suite des exposés de 1897 et 1901). Par le Col. J.-J. Lochmann.

Switzerland—Thurgau. **Früh.**
Zur Morphologie des untern Thurgau. (Beiträge zur Kenntnis des Rheingletschers.) Von J. Früh. (Sonderabdruck aus Heft xvii. der Mitteilungen der Thurg. Naturf. Gesellschaft.) Size 8 × 5½, pp. 24. *Sketch-map and Illustrations. Presented by the Author.*

Turkey—Albania. *B.S.R. Belge G.* 27 (1906): 224–236. **David.**
L'Albanie et la Chaîne du Pinde. Par M. l'abbé David. *With Illustrations.*

Turkey—Macedonia. *Ann. de G.* 15 (1906): 115–132, 249–266. **Cvijić.**
Remarques sur l'ethnographie de la Macédonie. Par J. Cvijić.

United Kingdom—Lake District. **Marr.**
[The Influence of the Geological Structure of English Lakeland upon its Present Features. A Study in Physiography.] Address delivered at the Anniversary Meeting of the Geological Society of London, on February 16, 1906. . . By John Edward Marr, SC.D. London, 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 128. *Sketch-maps and Sections.*

ASIA.

Asia—Desiccation. *Iz. Imp. Russian G. S.* 41 (1905): 507–521. **Berg.**
Is Central Asia drying up? By L. Berg. [In Russian.] St. Petersburg, 1905. *Also separate copy, presented by the Author.*

Noticed in the Monthly Record (March, p. 350).

Asia—Rainfall. *Ann. de G.* 15 (1906): 193–212. **Passerat.**
Les Pluies de mousson en Asie. Par C. Passerat. *With Maps.*

Ceylon. **Warren.**
Ceylon. Administration Reports, 1905. Part I. Civil. Survey Report of Mr. P. D. Warren, Surveyor-General. Size 13 × 8, pp. 82. *Maps and Illustrations. Presented by the Surveyor-General.*

China—Bibliography. **Cordier.**
Bibliotheca Sinica. Dictionnaire Bibliographique des ouvrages relatifs à l'Empire Chinois. Par H. Cordier. 2[me] Édn. Vols. 1, 2, and 3, Fasc. I. Paris: E. Guilmoto, 1904–1906. Size $11 \times 7\frac{1}{2}$, pp. 1992.

China—Sechuan. *M. Seminars f. Orientalische Sprachen* 9 (1906): *I. Abt.* 1–72. **Betz.**
Eine Reise in Szechuan von Chungking über Land nach Chengtu, Yachou, Chiating und Suifu. Von Dr. Betz. *With Plan and Illustrations.*

China—Shensi. *B. American G.S.* 38 (1906): 412–424. **Willis.**
Among the mountains of Shen-si. By Bailey Willis. *With Illustrations.*

China—Trade. ——
China. Imperial Maritime Customs. I. Statistical Series: Nos. 3 and 4. Returns of Trade and Trade Reports, 1905. Part I. Abstract of Statistics. Part II. Port Trade Statistics and Reports. Part III. Analysis of Foreign Trade. Shanghai, 1906. Size $11 \times 8\frac{1}{2}$, pp. (Part I.) lxxiv. and [120]; (Part II.) iv. and 554; (Part III.) 332. *Maps, Illustrations, and Diagrams. Presented.*

China—Yang-tse. **Tschepe.**
M. Seminars f. Orientalische Sprachen 9 (1906): *I. Abt.* 127–130.
Woher kommt der Name des Stromes Jangtsekiang? Von P. Albert Tschepe.

China—Yangtse. **Tschepe.**
M. Seminars f. Orientalische Sprachen 9 (1906): *I. Abt.* 134–146.
Der Nan-Kiang. Eine geographisch-historische Studie. Von P. Albert Tschepe.

India—Chota Nagpore. **Hahn.**
Blicke in die Geisteswelt der heidnischen Kols. Sammlung von Sagen, Märchen und Liedern der Oraon in Chota Nagpur. Von Ferdinand Hahn. Bevorwortet von Hermann Dalton. Gütersloh: C. Bertelsmann, 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. x. and 116. *Price 1 mark 50. Presented by the Publisher.*

India—Survey. *R. Engineers J.* 4 (1906): 199–226. **Burrard.**
An account of the scientific work of the Survey of India, and a comparison of its progress with that of foreign Surveys. By Lieut.-Colonel S. G. Burrard.

India—Survey. ——
Extracts from Narrative Reports of Officers of the Survey of India for the season 1903–04. Prepared under the direction of Colonel F. B. Longe. Calcutta, 1905. Size $13\frac{1}{2} \times 8\frac{1}{2}$, pp. 188. *Map. Presented by the Surveyor-General of India.*

India—United Provinces. *Mem. Asiatic S. Bengal* I (1905–6); 93–119. **Sherring.**
Notes on the Bhotias of Almora and British Garhwal. By C. A. Sherring.

Indian Ocean. *Z. Ges. Erdk. Berlin* (1906): 177–189. **Voeltzkow.**
Berichte über eine Reise nach Ost-Afrika zur Untersuchung der Bildung und des Aufbaues der Riffe und Inseln des westlichen Indischen Ozeans. Von Prof. Dr. A. Voeltzkow. VIII. Ceylon.

Tibet. *J. of Geology* 14 (1906): 599-617. **Huntington**
Pangong: a glacial lake in the Tibetan plateau. By Ellsworth Huntington. *With Map, Sections, and Illustrations.*
Noticed in the Monthly Record (April, p. 456).

AFRICA.

Africa—Diseases. **Balfour**
Second Report of the Wellcome Research Laboratories at the Gordon Memorial College, Khartoum. Andrew Balfour, M.D., Director. Khartoum, 1906. Size 11 × 7½, pp. 256. *Maps and Illustrations. Presented by the Director of the Laboratory.*

Algeria—Coasts. *Z. Ges. E. Berlin* (1906): 554-576. **Fischer.**
Küstenstudien und Reiseeindrücke aus Algerien. Von Prof. Dr. Theobald Fischer. *With Sketch-map and Illustrations.*

Canary Islands. *G.Z.* 12 (1906): 481-506. **Sapper.**
Die kanarischen Inseln. Eine geographische Studie. Von K. Sapper. *With Illustrations.*

Cape Colony. [**Gill.**]
Report of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty, 1905. London, 1906. Size 13 × 8½, pp. 16.

Central Africa—Mines. ———
Tanganyika Concessions, Limited. Engineers' and Managers' Reports on the Gold, Tin, and Copper Mines of Katanga (Congo Free State), also Reports on the Kansanshi Mine (North-Western Rhodesia). London, 1906. Size 11 × 8½, pp. 76. *Plate. Plans, Sections, and Maps (separate). Presented by Messrs. Robert Williams & Co.*
See note in the January number (p. 90).

Central Africa—Zoology. *P. Zoological S.* (1906): 180-227. **Cunnington and others.**
Zoological Results of the Third Tanganyika Expedition, conducted by Dr. W. A. Cunnington, 1904-05. Report on the Mollusca, by Edgar A. Smith. Report on the Macrurous Crustacea. By W. T. Calman. Report on the Oligochœta. By Frank E. Beddard. Report on the Porifera, with Notes on Species from the Nile and Zambesi. By R. Kirkpatrick. *With Plates.*

Congo. *Z. für Kolonialpolitik, etc.* 8 (1906): 746-763. **Kürchhoff.**
Die Nebenflüsse des Kongo als Verkehrsstrassen. Von D. Kürchhoff.

Congo. **Svambera.**
Travaux Géographiques Tchèques. I. Le Congo. (Accompagné d'un Résumé en Français.) Kongo. Napsal Dr. V. Svambera. Praha, 1901-1905. Size 11 × 8, pp. 386. *Presented by the Author.*

Congo State—Ethnology. *B.S.R. Belge G.* 30 (1906): 185-209, 299-324. **Védy.**
Ethnographie Congolaise: Les riverains de l'Uélé. Par le Dr. Védy. *With Map and Illustrations.*

Congo State—Geology. **Cornet.**
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Some facts about the Weather. By William Marriott. London: E. Stanford, 1906. Size 8½ × 5½, pp. 32. *Maps and Illustrations. Price 6d. Presented by the Author.*

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Ueber die Grösse der solaren Wärmemengen, welche in gegebenen Zeiten beliebigen Breiten der Erde zugestrahlt werden. Von Dr. Friedrich Hopfner. *With Diagram.*
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Oberflächentemperaturbeobachtungen in der Nordsee, September 1903—August 1904. Von Dr. E. van Everdingen. (Koninklijk Nederlandsch Meteorologisch Instituut, No. 102. Mededeelingen en Verhandelingen, No. 3.) Utrecht, 1906. Size 10 × 6½, pp. 10–24. *Charts.*

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The writer holds that future advance in geography will be in the direction of the more detailed study of local phenomena and their correlation with general principles.

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Cardiganshire, 29 (N.E. and S.E.), 37 N.E., S.E., 38 S.W., S.E., 44 N.E. **Carmarthenshire**, 4 S.E., 12 N.E., 15 S.W., 24 N.E., 57 S.E. **Cornwall**, 3 (N.W. and N.E.), S.E., 5 N.E., S.W., S.E., 8 S.E., 9 N.W., S.W., 11 S.E., 29 N.E. **Devonshire**, 26 S.E., 27 S.W., S.E., 38 N.E., 39 N.W., 50 N.W., S.E., 61 N.E., 62 S.E., 63 S.W., 87 N.W., S.E., 91 S.E., 97 N.W., 106 S.W., 112 N.W., 113 S.E., 117 N.E., 118 N.W., S.E., 119 N.W., N.E., 130 N.E., S.W., S.E., 132 S.W., 133 S.E., 135 S.E., 136 N.W., N.E., S.W., S.E., 137 (N.W. and N.E.), S.W., 138 N.W., 139 (N.W. and N.E.). **Lincolnshire**, 43 N.W., S.W., 44 N.E., S.W., S.E., 45 N.W., N.E., S.W., 46 N.E., S.W., 47 N.E., 48 S.E., 52 N.E., S.W., 53 N.E., 54 S.W., 55 N.E., S.W., 56 N.W., S.W., S.E., 57 N.W., S.W., 58 N.W., 67 S.E., 78 N.W., 137 N.W. **Norfolk**, 1 S.W., S.E., 2 S.W., S.E., 3 S.W., S.E., 4 S.W., S.E., (4*a* S.W. and 10 N.W.), 7 N.W., 9 N.E., S.E., (10 N.W. and 4*a* S.W.), 10 N.E., S.W., S.E., 11 (N.E. and S.E.), S.W., 12 S.W., 13 S.E., 17 S.E., 18 N.W., N.E., S.E., 19 S.W., S.E., 20 N.W., S.W., (20 S.E. and 20*a* S.W.), 21 S.E., 22 N.W., 24 N.W., 27 N.W., N.E., S.E., 28 N.W., S.W., S.E., 29 S.W., S.E., 37 N.W., N.E., 38 N.W., S.W., S.E., 45 N.W., S.W., S.E., 49 S.W., 50 N.W., N.E., 51 N.E., 56 N.E., S.E., 61 N.W., N.E., S.E., 62 N.W., S.W., 70 S.W., 73 N.E., 74 N.W., S.W., 86 N.W., S.W., S.E. **Pembrokeshire**, 2 S.E. **Yorkshire** (First Revision of 1891 Survey), 271 N.E., 273 N.W., 276 S.W., 280 (S.W. and S.E.). 1*s.* *each.*

25-inch—County Maps (first revision):—

Carmarthenshire, XXVIII. 11; XLIV. 6. **Cornwall**, X. 9, 15; XIV. 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XIX. 6, 14; XX. 5; XXI. 13; XXV. 3, 4, 5, 8, 9, 12, 14, 16; XXVI. 1, 2, 7, 8, 9, 10, 11, 13, 14, 15, 16; XXVII. 1, 5, 9; XXXII. 9; XXXIII. 12; XXXIV. 5; LIV. 1; XXXV. 1, 5, 9, 13; XXXVI. 6; XLIV. 14, 15; LIII. 9. **Devonshire**, CXXIII. 7. **Lincolnshire**, XXIX. 4; XXX. 9, 10, 11, 15, 16. **Pembrokeshire**, II. 9, 10, 13, 14; VI. 1, 2, 3, 4, 5, 6, 7, 8, 12; XI. 8. **Yorkshire** (First Revision of 1891 Survey), CCXXXVII. 4, 9, 16; CCXXXVIII. 6; CCXLVI. 8; CCXLVII. 2, 5, 6, 7, 9, 10, 14; CCXLVIII. 1, 4, 5, 11. **Kent** (Second Revision), XXV. 13; XXXVI. 1, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; XXXVII. 1, 5, 9, 13, 14; XLVII. 2, 3, 4, 6, 11, 12, 15, 16; XLVIII. 1, 5, 9; LVI. 6, 7, 8, 10, 11, 12, 14, 15, 16; LVII. 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15; LVIII. 1, 5, 9; LXVI. 2, 3, 4, 6, 7, 8, 11, 12; LXVII. 1, 2, 3, 5, 9. 3*s.* *each.*

(*E. Stanford, London Agent.*)

Europe—Central. **K. u. K. Militärgeographisches Institut.**

Hypsometrischen Uebersichtskarte von Mittel-Europa. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. Sheet J 8, Adrianople. Vienna: K. u. K. Militärgeographisches Institut, [1907].

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilungen der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 239, Salzwedel; 338, Bernburg; 364, Zörbig; 367, Finsterwalde. Berlin: K. Preussische Landesaufnahme, 1907. *Price* 1.50*m.* *each sheet.*

Luxemburg. **Hansen.**

Carte topographique du Grand Duché de Luxembourg. Par J. Hansen. Scale

1 : 50,000 or 1·3 inch to a stat. mile. Sheets: 3, Titre et légende; 6, Plateau de Ferschweiler; 13, Esch sur Alzette; 14, Bettembourg. Paris: J. Hansen, 1907.

With the publication of these sheets this map is complete. It is based upon surveys made between the years 1883 and 1906, and consists altogether of fifteen coloured sheets. The relief is shown by brown form lines, which must not, however, be mistaken for regular contours; heights are given in figures. A considerable amount of detailed information is given by symbols, and Mr. Hansen, the experienced cartographer responsible for the map, may be congratulated upon having brought to a successful termination the work he has undertaken.

Vienna. **Artaria.**

Plan von Wien. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Vienna; Artaria & Co., 1907. *Price* 2.40 *kr. Presented by the Publisher.*

ASIA.

Malay Archipelago. **Supan.**

Die Sunda Gräben am Südrande des Malaischen Archipels. Nach den neuesten Lotungen S.M.S. *Planet* von A. Supan. Scale 1 : 12,500,000 or 1 inch to 197·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 6. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

Persia. **Herzfeld.**

Routenkarte von Bachdād nach Šīrāz durch Lūristān, Khūzistān und Fārs. Nach eigenen Aufnahmen von Ernst Herzfeld. Blatt 1. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 5. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: (Somaliland) 68—I, J; (Uganda), 86—B, F. London: Topographical Section, General Staff, War Office, 1905. *Price* 1*s*. 6*d*. *each sheet. Presented by the Director of Military Operations.*

Algeria and Tunis. **Niox.**

Algérie et Tunisie. Par G. Niox. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. Paris: Ch. Delagrave, 1907.

A new edition of a general map of Algeria and Tunis, forming No. 23 of the Atlas Niox. It is a somewhat rough production.

Cape Colony. **Cape Geological Commission.**

Geological map of the colony of the Cape of Good Hope. Scale 1 : 238,000 or 1 inch to 3·7 stat. miles. Sheets: 2, 4, 45. Cape Town: Geological Commission, 1906–7. *Price* 2*s*. 6*d*. *each sheet. Presented by the Director, Geological Survey of the Cape of Good Hope.*

As evidenced by these sheets, the Geological Survey of the Cape Colony is now making steady progress. Mr. A. W. Rogers, who is responsible for the greater part of the work here shown, is not only a most thorough and enthusiastic geologist, but possesses a good knowledge of geographical surveying, so that where necessary he is able to undertake the construction of the geographical map upon which to base the geological features. Sheet 2 shows the geology of the country in the neighbourhood of Montague, Swellendam, Heidelburg, and Riversdale, together with the coast-line from Struis bay to Cape Barracouta; sheet 4 extends from the coast at Saldanha bay to beyond Porterville and Worcester; and sheet 45 include the neighbourhood of Daniels Kuil, in Griqualand West.

Gold Coast. **Topographical Section, General Staff.**

Gold Coast: Northern Territories. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1906. *Price* 2*s*. *Presented by the Director of Military Operations.*

North-Eastern Rhodesia. **Beringer.**

North-Eastern Rhodesia. Provisional map. Compiled by O. L. Beringer from information collected in the Survey Office and from surveys made by the Survey Department of North-Eastern Rhodesia. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. [London, 1907.]

Although stated to be merely provisional, this map is by far the best that has

hitherto appeared of Northern Rhodesia. It is based upon route traverses checked by astronomical observations for latitude and chronometric differences of longitude, combined with extensive plane-table surveys. Relief is shown by approximate contour-lines in brown, but too much reliance must not be placed upon these. The map has been compiled by Mr. O. L. Beringer, who, as a surveyor, has already done excellent work in this part of Africa, from his own surveys and the most reliable information in the survey department of North-Eastern Rhodesia. A reduction of the map with some additional information was published in the April number of the *Geographical Journal*, to accompany the paper of Mr. L. A. Wallace.

AMERICA.

Canada. **Department of Militia and Defence.**

Topographic map of Canada. Scale 1 : 63,360 or 1 inch to a stat. mile. Ontario. Sheet 6, Welland. London: Topographical Section, General Staff, War Office. Ottawa: Intelligence Branch, Department of Militia and Defence, 1907. *Presented by the Director of Military Operations.*

A sheet of the new topographical map of Ontario, noticed in the last number of the *Geographical Journal*. It embraces the district bordering on Lake Erie, from Lapp point to Windmill point, and extends northward from the lake as far as Welland.

Canada—Nova Scotia. **Canadian Geological Survey.**

Geological Survey of Canada. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Province of Nova Scotia. Sheets: 59–65, 74–76, 82, 83. Ottawa: Geological Survey Office, 1905. *Presented by the Geological Survey of Canada.*

These sheets include the portion of Nova Scotia lying between Northumberland Straits, Cobequid bay, and Mines bay. The geology is well shown, and upon each sheet there is a good index to the colours and symbols employed. Apart from their primary use as depicting the geological features of the district, the sheets contain much information of a general geographical nature.

North America. **Mackinder.**

Stanford's New Orographical Map of North America. Compiled under the direction of H. J. Mackinder, M.A. Scale 1 : 6,013,500 or 1 inch to 94·9 stat. miles. 4 sheets. London: Edward Stanford, 1906. *Price 16s. Presented by the Publisher.*

One of the useful series of orographical wall-maps now being published under the direction of Mr. H. J. Mackinder, M.A., notices of which have appeared from time to time in this *Journal*. It is similar in style to those previously published, and is in every respect a most worthy addition to this excellent series of educational maps.

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, exports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Parts 20, 21, and 22. London: George Newnes, Ltd., [1907]. *Price 6d. each part. Presented by the Publisher.*

The following are the contents of these three parts of the atlas:—Part 20, Plates: 21, Aspects of British trade, foreign and colonial; 22, 23, World—commercial highways, comparative shipping trade; 24, International shipping; 173, 174, 175, Fish oils, hides and skins; 176, Dyeing materials. Part 21, Plates: 1, Commercial growth of nations; 2, 3, World—natural vegetation, temperature of ocean surface, etc.; 4, World—temperature charts; 169, Vegetable oils, etc.; 170, 171, 172, Opium, drugs, etc., statistics. Part 22, Plates: 17, Imports and exports of various countries; 18, 19, World—total British trade; 20, Aspects of British trade; 165, 166, 167, Ivory, gums, resin, wax, etc.; 168, Vegetable oils, etc. In addition to the maps and diagrams, each of these parts contains a continuation of the 'Commercial Gazetteer of Countries and Ports.'

The publication of Part 22 brings this most useful and important atlas to a close. All that was anticipated in the notice of the first part (*Geographical Journal*, May, 1906) has been fulfilled, and the work comprises a vast amount of information on all matters connected with economics and commercial geography generally. This information, instead of being merely stated in columns of figures which often convey little meaning, is graphically and intelligibly presented to the student by means of carefully drawn and coloured maps and diagrams, supplemented by text, in all cases written by experts on the subjects dealt with. The complete atlas consists of 176

large pages of coloured plates, containing upwards of 1000 maps and diagrams in addition to the text, and the labour and research entailed in its compilation must have been enormous. In an undertaking of this kind some mistakes must naturally occur, but it is safe to say that these are few and far between. Where such have been noted after publication of the part in which they occur, the corrections will be found on a page given with the last part. There can be no doubt that as the atlas becomes known it will be appreciated by all those who are interested in the world's trade and commerce. Whatever the result may be as regards financial success, Mr. Bartholomew will have the satisfaction of knowing that he has added another to his already long list of useful geographical publications. The atlas has been dedicated to the Right Hon. Sir George Taubman Goldie, K.C.M.G., etc., the President of this Society.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams and 105,000 references. Part 10, 11, and 12. London: The Amalgamated Press, Ltd., 1907. *Price 7d. each part.*

These parts contain the following maps:—Part 10, Nos.: 41–42, West and South-West Ireland; 129–130, Japanese Empire; 207–208, New Zealand and Tasmania. Part 11, Nos.: 33–34, Scottish highlands; 117–118, Bengal provinces and Burmah; 121–122, East Indies (industries and communications). Part 12, Nos.: 83, 84, Southern Italy; 91–92, Norway and Sweden; 199–200, Australasia (industries and communications).

World. **Ravenstein.**

Philips' Handy-Volume Atlas of the World, containing seventy-two new and specially engraved plates, with statistical notes and complete index. Seventh edition, revised to date. By E. G. Ravenstein, F.R.G.S. London: George Philip & Son, Ltd., 1907. *Price 3s. 6d. Presented by the Publisher.*

World. **Schrader, Prudent, and Anthoine.**

Atlas de Géographie moderne. Par F. Schrader, Lieut.-Colonel F. Prudent et E. Anthoine. Nouvelle édition. Paris: Hachette et Cie., 1907. *Price 25 fr.*

No extensive alterations or additions have been made in this edition, and in general appearance and number of maps it remains much as it was when first published. Several new diagrams and small maps are here given for the first time, and alterations have been made in the text to bring it up to date. In some respects the revision has not been so thorough as might have been expected. For instance, the South Polar map (No. 1) does not show the results of the most recent explorations, no notice being taken even of Captain Scott's work, although on the block map accompanying No. 3 this is shown. On Map 39 the railway across Asia Minor is shown as only constructed as far as Konia; and several of the maps dealing with Africa certainly need further revision, specially as regards boundaries. The map of Canada (No. 56) is decidedly out of date as regards the Arctic Regions, Captain Sverdrup's discoveries being utterly ignored. Still this is really a good general atlas, on modern lines, and one that has rightly obtained a considerable reputation.

World. **Schrader.**

Atlas de Géographie Historique. Par une réunion de professeurs et savants sous la direction géographique de F. Schrader. Nouvelle édition. Paris: Hachette et Cie., 1907. *Price 35 fr.*

A new and revised edition of this useful general historical atlas. The alterations are few, and the number of maps and their arrangement are as before.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas verkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 43, 44, 45, and 46. Gotha: Justus Perthes, 1907. *Price 60 pf. each part.*

These parts contain the following maps:—Parts 43-44, Nos.: 30, Frankreich, Bl. 4; 65, Japan, Korea, und Ost-China; 84, Ost-Canada; 97, Süd-Amerika, Bl. 3. Part 45-46, Nos: 54, Balkan-Halbinsel, Bl. 4; 82, Nord-Amerika (Uebersicht); 94, Süd-Amerika (Uebersicht).

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during February, 1907. *Presented by the Hydrographer, Admiralty.*

to Kangra valley; (4) A bullock-cart crossing a small branch of the Bias river; (5) A ferry-boat on the Bias river; (6) Loading a ferry-boat.

Sahara. **Hilton-Simpson.**

Eighty-eight photographs of the Sahara, taken by M. W. Hilton-Simpson, Esq. *Presented by M. W. Hilton-Simpson, Esq.*

These photographs, twenty-two of which are excellent panoramas, were taken during Mr. Hilton-Simpson's travels in the Sahara, south of Algeria and Tunis, in the winter of 1905–6. They form a continuation of those presented in 1905. As may be judged from the titles, among them are some good typical desert scenes.

(1) The bridge over the Wad Gabes at the suburb of Jara, Gabes; (2) A street thatched with date-palm leaves near the market, Gabes; (3) Pool at Shenini, a suburb of Gabes; (4) Beduin tent at Shenini; (5) Sunset in the oasis of Gabes; (6) An old negro clown who performs in Jara and Menzel, Gabes; (7) My camp at Hadeij; (8) Mouth of rain-water cistern, Hadeij; (9) Crossing the bed of the Wad just north of Hadeij; (10) Troglodyte Jews of Hadeij; (11) A Jewish troglodyte family of Hadeij; (12 and 13) Mouth of troglodyte dwellings, Hadeij; (14) Bordj Tual, a small French-built caravanserai; (15) The market-place, Gafsa; (16) A girl of Gafsa; (17) Women washing clothes at Gafsa; (18) The ancient Roman baths beside the Kaïds house at Gafsa; (19) Beduin tent, Gafsa; (20) A caravan of kerratas or carts going from Gabes to Gafsa; (21) In the market-place at Udref; (22) Market-place and mosque at El Guettar; (23) Mosque at El Guettar; (24) Camp at Bir Marbot; (25) View, 6 miles south-west of Gafsa; (26) A Roman column lying in the desert; (27) A grave in the desert between Gafsa and Tozer; (28) Tozer during a dust-storm; (29) House of mud tiles in the market-place at Tozer; (30) A warm spring at Kriz; (31) The market-place, Nefta; (32) A tile-decorated house at Nefta; (33) A pool in the oasis of Nefta; (34) Market-place and minaret of mosque, El Wad; (35) A well at El Wad; (36) Date palm groves between the dunes of sand at El Wad; (37) Debila, a village north of El Wad; (38) The well, Bir Asli, on the frontier of Algeria and Tunis; (39) Heavy "going" in the loose sand of the dunes between Debila and El Wad; (40) Messaoud Ben bou Toyeb, a famous Shaamba chief; (41 and 42) Market-place, Tuggurt; (43) Door of Zawia at Tamelath; (44) An old Uled Naïl woman, Tuggurt; (45) Crowd welcoming a famous marabout, Tuggurt; (46) Uled Naïl danseuse, Tuggurt; (47) Uled Naïl danseuses, Tuggurt; (48) Temassin; (49) The market-place, Temassin; (50) Small salt lake at Temassin; (51) A street in Tamelath leading to the famous mosque; (52) French-built mosque at Sidi Khelil; (53) Interior of Borj or caravanserai of Bled et Ahmar; (54) Camels carrying the "bassoors" or tents, in which women travel; (55 and 56) The market-place, Wargla; (57) Looking north-east from a mosque minaret; (58) Mission station of the Pères blancs, Wargla; (59) A woman of the Beni Brahim tribe, Wargla; (60) A "mehari," or trotting-camel, Wargla; (61) Open space outside the Bureau Arabe, Wargla; (62) Street in the Beni Brahim quarter at Wargla; (63) In the oasis of Ajaja; (64) Part of the filled-in moat at Wargla; (65) Rivulet running under ruined house at Ajaja; (66) Susa, from the sea; (67) The Wad Gabes and bridge of Jara, Gabes; (68) Shenini, a suburb of Gabes; (69) The "wad" outside the oasis of Gafsa; (70) View of the mountains, looking northward, from a point a few miles west of the wells of Mehamla, Tunisian Sahara; (71) The country on the western side of the Shott Melrir; (72) Zawia of El Bour, near N'Gussa; (73) A view in the Matmata hills, looking northward from Hadeij; (74) River-bed near Hadeij, in the Matmata hills; (75) Tamelath; (76) Outside the borj at Biar Krebach; (77) Outside Borj Gouifla; (78) Uled Naïl tents, Tuggurt; (79) Beduin camp between Tuggurt and Wargla; (80) The great sea of sand-dunes between El Wad and Tuggurt; (81) One of my camps between Tuggurt and Wargla; (82) El Wad from the great dune to the west of the town; (83) El Wad from the north-east; (84) Wargla from the south; (85) Bureau Arabe, Wargla; (86) Looking eastward from the minaret at Wargla; (87) The shott a mile or two east of Wargla.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

ARCTIC EXPLORATIONS

AMUNDSEN.

THE GEOGRAPHICAL JOURNAL 1907.

100

CUTCH AND THE RAN.
SIVEWRIGHT

The

Geographical Journal.

No. 6. JUNE, 1907. Vol. XXIX.

A JOURNEY ACROSS ASIA FROM LEH TO PEKING.*

By Major C. D. BRUCE.

In a paper published in the *Geographical Journal*, January, 1906, some instructive remarks were made on "the Present Problems of Geography." A plea was there put forward on behalf of the non-specialist; and to travellers such as Captain Layard and myself, with aims and intentions of the best kind, yet who in so many ways lack the necessary geographical education to enable them to fulfil those aims, there is much comfort to be found in this plea. After defining geography as "the Science which deals with the forms of relief of the Earth's crust, and with the influence which these forms exercise in the distribution of all other phenomena," the author of the paper continues, "It is convenient and often profitable for a man of science to have a recognized label, but it seems to me that important advances are to be made by cultivating those corners of the field of knowledge which lie between the patches where the labelled specialists toil in recognized and respected supremacy." It is in these words that I find the only justification for venturing to attempt to lay before you the results of a journey across Asia, in the hope that we shall have been found to have cultivated, in however small a degree, some of the "corners of the field of knowledge" above referred to.

The course of the journey which you will hear of to-night may be best described as one of length without breadth. Its object was not the exploration of any one tract or country in detail, but, in the first place, the acquisition of whatever knowledge, geographical and otherwise, it was possible to collect of the regions through which we passed,

* Read at the Royal Geographical Society, January 28, 1907. Map, p. 700.

and, in the second, the making of a more or less detailed route-survey, day by day, mile by mile, from Leh to Peking. The second, and by far the more arduous of the two objects, was only carried through thanks to the wonderful determination and pluck of our Indian surveyor, a Sikh, Lall Sing by name, lent by the Survey of India. To carry on such work as Lall Sing did daily, with frequent night observations at altitudes over 16,000 feet in Northern Tibet so late in the year as the middle of October, moving nearly every day for nine months on end, is a feat which any man, even with the reputation which those who work for the Survey of India enjoy, may, I think you will agree, well be proud of.

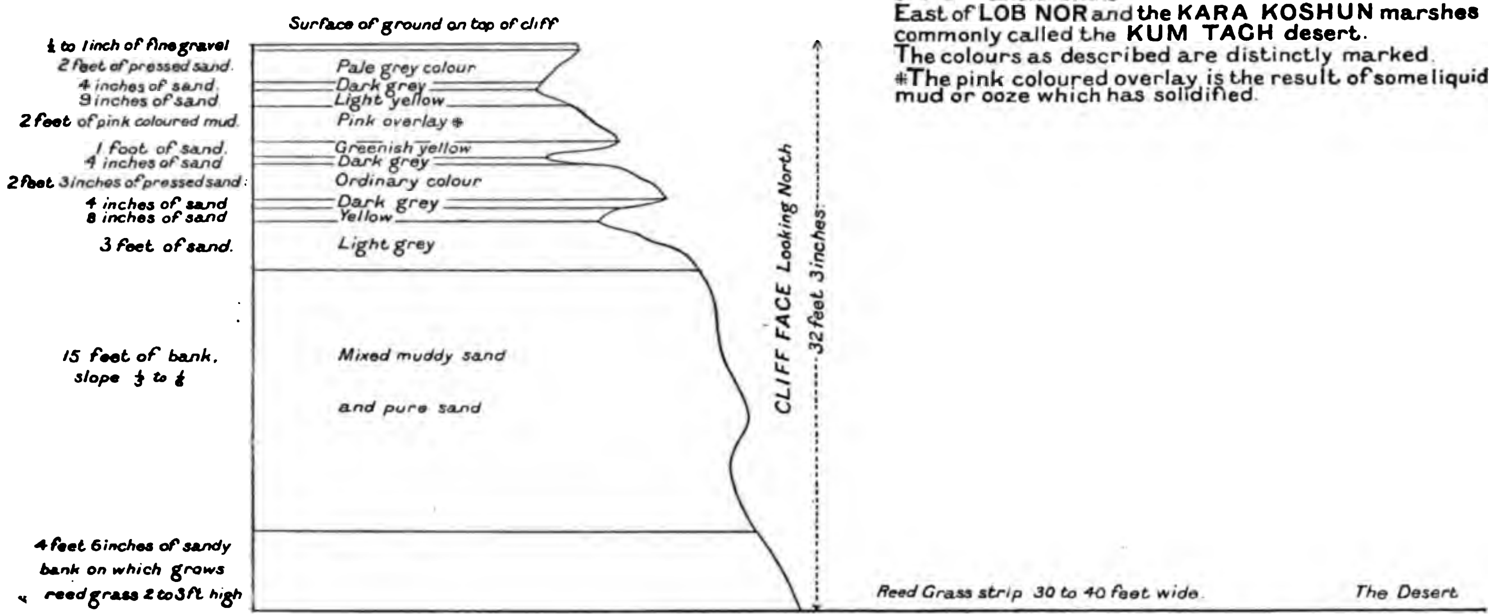
That portion of the continent of Asia traversed by us between Leh and Peking divides itself naturally, from the geographical point of view, into three distinct parts. The first comprises the tract between Leh in Ladak and the Kuen Lun mountains, including the Chang Chenmo and North-Western Tibet. The second, which occupied us nearly three months, was entirely made up of Chinese Turkestan; and the third includes the latter portion of our journey through China proper, which lasted three months.

Over the first portion, from Leh to the Kuen Lun, previous exploration has been chiefly confined to various surveys and attempts to obtain an alternative route between Ladak, or Rudok, and Chinese Turkestan, for such seems to have been the idea actuating some of those who have faced this inhospitable country. From the time when Dr. Thompson, the associate of Cunningham and Henry Strachey in the Ladak boundary commission of 1847, first surmounted the Karakoram range, and that of the Schlagentweit brothers, one of whom was murdered at Kashgar, this wild region has always exercised a fascination peculiar to itself.

The country included in the second portion of our journey, viz. Chinese Turkestan, is now, after many years of comparative obscurity, once more attracting renewed attention. Fifteen hundred years ago there was a route which follows the southern border of the central desert of Chinese Turkestan, edging its way along the northern base of the Kuen Lun range. This route was then as well known, at any rate to the Chinese who controlled it, as it is to-day, and the reason is this: At the commencement of our era Buddhism first began to find its way to China from India, and ancient Chinese records prove that it was chiefly by the passage to and fro along this very route of many devotees, priests, and pilgrims that the transformation took place.

According to Chinese annals the best known of these pilgrims were two travellers of that race—Fa Hien, who passed from China to India about 450 A.D., and Hiuen Tsiang, who went and came two centuries later. Both were born travellers, and both have left records as interesting as they are authentic. About 1270 A.D. came the greatest traveller of all, Sieur Marco Polo. After traversing part of what is now Afghanistan,

Exposed rough section of Sand Cliff forming Southern shore of ancient lake or sea of the Central Basin of Asia East of LOB NOR and the KARA KOSHUN marshes commonly called the KUM TACH desert.
The colours as described are distinctly marked.
*The pink coloured overlay is the result of some liquid mud or ooze which has solidified.



Where the surface of the desert is rolling sand, now frozen hard, the direection of the lesser ridges is uniformly at right angles to the prevailing N.E. Wind.

he struck down from Badakshan to Kashgar, and continued eastwards through Khotan, Kiria, and Lob Nor to Sachu—by our very route. The journey ended in his case at Shangtu (the then summer residence of Kublai Khan), 300 miles north of Peking, outside the Great Wall. In modern times the names of Prjevalsky, Roborovsky, Kozloff, as well as other gallant Russian explorers, are intimately associated with southern Chinese Turkestan. Another famous European traveller, Sven Hedin, it need hardly be said, has made his name a household word throughout the whole central desert basin. And the names of four intrepid Frenchmen, Bonvalot, Grenard, Dutreuil de Rhins, and Prince Henri d'Orleans, will always be connected with that region. Of English men and women, Captain Deasy, Mr. and Mrs. Littledale, Bower, and Malcolm are well known among determined explorers who have passed that way; and Dr. Stein, the eminent archæologist, is even now continuing those fascinating explorations which have already done so much to confirm and explain early Chinese records.

The third part of our journey was through China proper. Although it might seem as if that portion should be by far the best known of all, curious as it may appear—this is not the case. The route from Chia-yu-kuan, the ancient north-west "gate" of China, where in early times all embassies from the west were forced to await the pleasure of the mighty emperors of Cathay, up to Lan Chou, the capital of Kan-su province on the Yellow river, has not been traversed by more than a dozen Englishmen in the last fifty years. Of that number, the name of Colonel Mark Bell stands out pre-eminently. From Lan Chou to Tai-Yuan Fu, the route we followed across East Kan-su, Shen-Hsi, and Shan-Hsi provinces to Peking, though comparatively close to civilization, is little known, for in not a few villages entered we were told that Europeans had never before been seen.

This, in brief, is an outline of the whole journey, and I will now endeavour to describe in some detail the leading physical features of the country along our route.

Leh, the capital of Ladak, is well known as the starting-point of, or the goal for, most Central Asian expeditions. It is here that caravans must be made up; food, animals, and men bought and hired; and it is not until Leh has been left behind that the traveller feels that he has cut the painter which has hitherto tied him to civilization.

From Leh to the Tibetan border, including the Chang Chenmo, the country is, comparatively speaking, well known. After surmounting in succession three high passes, the Chang La of 17,000 feet, the Masemik La of 17,600 feet, and the Lanak La of 17,750 feet, the Tibet border is reached. Two out of the three passes, though high, present no difficulty, when as we crossed them there was no snow. How simple the passage is may be imagined when it is stated that, riding on in advance of the caravan, I arrived at the summit of the Masemik La without any idea

that the top of the pass had been reached. On entering Tibet proper, very little change in the aspect or physical character of the land is to be found. As in the Chang Chenmo, so in Tibet, the same open undulating valleys have to be crossed. Common to both sides of the border are the high plateaux, whose surrounding ranges reach over 17,000 feet, the dividing passes, and the trickling streams, which so rapidly disappear into the thirsty soil. One new feature is met with in the lakes, some of which are fresh, others distinctly salt. There are also many ancient lake-beds plainly marked, where the evidence of previous glacial action may usually be traced.

SURVEYOR LALL SING AND RAI SAHIB AT WORK ON THE TOP OF LANAK LA, 17,750 FEET.

Of vegetation in North-West Tibet there is no sign save two or three kinds of poor grass, and the "boortsa" so necessary for fuel. Animal life, though at first common, practically disappeared as we drew up to the southern side of the Kuen Lun range. Tibetan antelope covered some of the less inhospitable valleys, and kyang, the wild ass, were not infrequent. During the whole of our stay in Tibet, only one wild yak was seen, and he, unfortunately for himself, paid for the meeting with his life, as meat that day was an absolute necessity for the caravan. Of the human race or its habitations we found no sign. From the day the Tibetan border was crossed until the gorges of the Kuen Lun had been partly passed, no trace of human beings was seen, not even a black tent used by the nomads who roam the country farther south.

From the description I have given you, it will not be hard to imagine the wearying monotony of this lonely land, and it might be supposed that Nature would have taken little pains to hedge it off from the neighbouring world. But this is far from being the case. On the northern side she has planted, in the shape of the dreaded Kuen Lun mountains, such a barrier that even the daring Russian explorers already alluded to were fain to allow themselves baffled in their attempts to find a feasible route other than the one we used.

Upon the immediate southern side of the Kuen Lun we were compelled to halt to refit and rest our animals in the only possible spot, known to the natives of Polu as the Baba Hatten valley, where so late in the year some little grazing could still be got.

For two days previous to entering the Baba Hatun valley, our way had lain over perhaps the worst ground we had to cross in Tibet. West of the valley we were following ran a magnificent range of eternally snow-clad mountains, whose highest peaks, which later form one boundary of the Baba Hatun valley, reach over 21,000 feet. Such a landmark do these form that, though no new discovery was involved, we felt that as a geographical feature they ought to carry a separate name. We therefore took the liberty of giving them that of the Curzon range. Opposite to this latter, on the north-east side of the same valley, stands a wonderful group of rugged peaks and ridges also covered with eternal snows. Both offer on either hand as grand and awe-inspiring a view as the human eye could wish for. We again felt that such a unique mass of peaks deserved recognition and a separate entity, so took the liberty of giving it the name of the Kitchener group.

Leaving the Baba Hatun valley by a difficult pass called the Ak-Su La, we camped the next night but one on what is known as the Gu Gut plain. This is a wide open expanse, some 18 miles in length from east to west, with a greatest breadth of 6 to 7 miles from north to south. It is surrounded on all sides by high rugged ranges, some of whose snow-clad cliffs reach over 18,000 feet. They afforded a magnificent view as the sun gained power at midday, lighting up their needle-like peaks in all the wonderful purity these fascinating snow-fields present.

Reference has already been made to the prevalence of old lake-beds in this portion of north-west Tibet, and the Gu Gut plain presents as reasonable an example of the physical geography of these on a larger scale as any. In extent, some 18 miles by 7, the plain is bordered on its northern sides by main ridges of the Kuen-Lun range, which reach over 17,000 feet. Both at the east and west ends the surrounding mountains are lower. The western half of the plain differs entirely in character from the eastern. The former is flat gravelly shingle, rising gradually north and south to the mountains on either side. The eastern portion is not flat, but consists, on its southern side, of a series of ridges and hollows running in all directions, most distressing to pack-animals.

These ridges vary from 20 to 60 feet in height, occasionally bursting into small hills running up to 100 feet above the plain. Both hollows and ridges are thickly sown with an outcrop of volcanic-looking black rock, which makes progress by no means easy.

On the south side of the plain lie three small lakes, the largest some 3 miles by 2 in area, and these are separated from one another by as much as 4 miles in the case of the two most eastern lakes. Ulug Kul, the first lake, so called by Deasy—our guide knew no name—is salt, and on October 15, though at an elevation of 15,200 feet, it was quite free from ice. Atchik-Kul, the second, at its eastern end, tasted sufficiently salt to be unpleasant to men. The animals, however, drank it greedily,

NEAR LOB NOR. MIDDAY REST AT A WATER-HOLE.

not having had any water the previous day. In contrast to Ulug Kul, this lake was frozen almost completely over. At the west end, where we subsequently camped, the water from a channel connected with the lake was quite sweet. All the lakes are either shrinking, which does not appear probable from the surrounding indications, or at other seasons must be 5 or 6 feet above their then level.

The following day we crossed what has all the appearance of an old lake-bed, as we made for the mountains forming the northern border and barrier of the plain. In this plain and rising above these channels in the dry pond-like beds are irregular-shaped pillars and mounds, showing in places what would appear to be an older level of at least

15 feet above the present one. From the general aspect of the southern surface of the plain sufficient indications are found to show that the whole lower side of the Gu Gut plain may once have been one large lake. How long ago, if ever, is a matter for the specialist to decide.

From the northern edge of the plain the actual passage of the Kuen Lun mountains commences. This passage occupied us five days, and we covered just over 30 miles in transit. It was 2 p.m. by the time we had climbed the first pass out of the Gu Gut plain, and much too late at that season of the year to commence such a descent as that which lay before us. This pass was not that made use of by Deasy, as, our guide being most uncertain about any possible passes, we had ourselves pushed ahead, and Captain Layard, Lall Sing, and myself climbed a pass the caravan were afterwards unable to negotiate. Upon the north side the snow lay 18 inches to 2 feet deep, and there a wind raged which was, even for Tibet, more cruel than usual. After rejoining the caravan, the view which met our eyes as we gazed through the falling snow northwards into and over the Kuen Lun, was one neither my companions nor myself are ever likely to forget. Below and on three sides of us, stretching apparently without end, lay the wildest and most forbidding jumble of mountain ranges, peaks, and gorges imaginable. Of all shapes—crossing and recrossing in every direction, needle-pointed, flat, or rugged and broken, they had only one common feature, and that lay in their apparently inaccessible nature. There was, however, no time to waste, whatever doubts for the moment crept through our minds, it was imperative to go on, so we commenced the first descent down a slope like the side of a house, full of holes and boulders, and over the knees of the animals in snow.

For the next four days we struggled down a succession of water-courses and narrow gorges one after another, making sorry progress at times, but always in the right direction. The main gorge, known to the people of Polu at its northern end as the Zubéshie gorge, was more like a gigantic railway cutting winding through solid rock than anything else, the sides frequently sheer for hundreds of feet on either side, the bottom just sufficiently wide for a frozen brook a few yards in breadth. Into these gorges the sun rarely penetrates, and at night, when the moon is overhead, few more weird and desolate scenes can be imagined.

Though of no importance geographically, it may be of interest, perhaps, in order to show the difficulties of progress, to state that on one of the four days the caravan could only cover 1¼ mile, and this took over four hours, at the end of which time men and animals were quite exhausted from constantly unloading and reloading every single pack. Another day 7 miles was the result of nearly ten hours' severe labour. In fact, had not the Beg, or local headman of Polu, sent out

a party of men and donkeys to help us the last day, in all probability most of our animals would have left their bones among the mountains.

Of vegetation in the Kuen Lun there is practically nône, and it was the want of even such miserable grass as had been scarce enough in Tibet that brought our animals to the state they had reached when we received help from the people of Polu. As we descended, the physical character of the surrounding mountains gradually changed.

VIEW OF MOUNTAIN PEAKS FROM THE FIRST PASS INTO THE KUEN LUN RANGE.

Slaty deposits replaced pure rock, while the lower spurs become shaly soft grey earth which the wind carries in clouds, causing a constant haze. Below 10,400 feet ice on the streams ceased, and between 10,000 and 9000 feet the first sign of vegetation in the shape of a few rushes, a few withered briars, and some wild clematis became apparent. It is difficult to refrain from smiling, even now, when one recalls our excitement on reaching a turn where the last bit of gorge opened out into something of a valley, for there in the distance was to be seen one

solitary stunted tree. It was the first we had met since leaving the Indus valley.

Clear of the gorge, the character of the country undergoes a startling and rapid transformation. Instead of the rock cutting and perpendicular cliffs, the track descends into rolling dust-coloured hills and open downs at a height of 8400 feet. These are covered with a small close-growing vetch, which in the spring probably affords excellent grazing. Not a vestige of trees, grass, or other vegetation is to be seen except this vetch. At a little distance away from the mountains and entrance to the gorge, the sudden geological change is still more apparent. The last jagged range, snow-clad throughout most of its height, gives way, almost as though in one step, to dust-coloured hills 2000 feet lower in altitude. These in their turn, as we descended after leaving Polu to Kiria, merge very gradually into rolling sand-hills, and our track passed through dunes and swelling hillocks of the same kind until the fertile oasis round Kiria is reached.

In discussing the loess formation of Northern China, Richthofen has traced its limits as far as the country through which he himself had travelled, and he remarks, "I do not positively know how far it extends in the direction of Central Asia." At the time of our passing Polu, I was impressed with the similarity in the constitution of the hill country immediately adjacent to the mountains to that of loess, and after travelling for months through the great loess country of Northern China, my impression is confirmed. It may be thought that the loess formation is not usually found at such an elevation, but Richthofen has also shown that "the difference of level of the places where loess occurs is truly remarkable. Where," he writes, "its hills fringe the plain of the Yellow river, they rise only a few hundred feet above the level of the sea. But in climbing up to higher regions, one never loses sight of the yellow soil. In Shan-Hsi," he continues, "I found it largely predominating over everything else at altitudes up to 6000 feet, and met it in many places of greater elevation on the Wu-tai Shan at 8000 feet. Where it adjoins a mountain range, deep cuts will expose layers of rocky *débris* intercalated more or less frequently between those of loess."

About the origin of the loess formation itself, opinions once certainly varied. Whether this is still the case I am unable to say, but our own experience, for what it is worth, goes to uphold the theory that the loess formation is not stratified, and has a tendency to vertical cleavage; also that it is not of subaqueous, but of subaërial origin.

Before passing on to the second portion of our journey, the country embraced under the name of Chinese Turkestan, a few words may be of interest concerning the gold industry of the Kuen Lun. During our struggle through the mountains we had been overtaken by two small parties of men, found later on to be residents of Polu and Kiria, the last of the gold-seekers who had proceeded into the mountains in the spring

of the year. We had noticed, all along the Zubéshie gorge, traces of their work in the shape of numerous "pockets," mostly disused. Some of these were to be seen in inaccessible-looking spots, up side ravines, and even high up in the faces of the almost sheer cliffs. The name "Zubéshie" means gold extracting, and, judging by the traces of workings to be seen, the name appears aptly chosen. The industry is carried on by natives of Polu and Kiria, whose custom it is for parties of three to five men to go up into the mountains in the spring, carrying with them only the absolute necessaries of life, and remaining just so long as they can make their provisions last, or until the approach of the winter and the snow drives them down again. Donkeys are occasionally taken to carry the small packs, but in most cases each man shoulders his own. A very hard life it is, and the attraction must be strong. East of Kiria, all along the northern base of the Kuen-Lun, gold is worked at intervals, to which reference will be made further on in this paper.

At Kiria the ancient Buddhist high-road previously mentioned is reached on the borderland of the Takla Makan desert, and the traveller finds himself on the edge of that wonderful Central Asian basin, which stretches for a distance of 2500 miles, from the Alai mountains as far east as the western slopes of the Khingan range in Manchuria.

In spite of what has already been done here in the way of exploration, it is more than possible that we are only beginning to unravel many of the archæological and historical mysteries connected with a former and far more flourishing state in the western half of this vast area. Few more fascinating scenes for such work are to be found in the present day. Unfortunately, China, which from its past history, and, in spite of Western criticism, its present wonderful state of general civilization, ought to be a subject of interest, especially to our countrymen, is even now a sealed book to the great majority. Why this should be so it is difficult to imagine. One reason, perhaps, lies in the difficulty—nay, almost impossibility to dwellers in Europe—of becoming acquainted with either its present or past records. Intimately connected as these records show China to have always been with the middle East, even as early as the first century, we in Europe have little knowledge of them, and until it is more widely realized how close this connection was with our own great Indian empire, and that almost entirely by means of the ancient route of which I am endeavouring to give you some idea to-night, interest in the early civilization of China, and from that in its latter history and future, will, I fear, be confined to a very limited number of inquirers.

The town of Kiria has been identified with the Pein of Marco Polo, who passed through it about A.D. 1274. From Kiria eastwards to the border of China proper, there were in the past two main routes. From Kiria to Chakalik, some 60 miles south-west of Lob Nor, one track goes almost in a straight line east-north-east down the Cherchen river.

The second, after leaving Kiria again, leads back to the base of the Kuen Lun mountains, and proceeds along the foot of the lowest spurs of the Altyn Tag to Chakalik. Historically, the former is of most interest, as it leads past the sites of various now buried cities, and undoubtedly is the former pilgrim route, but for other reasons we chose the mountain track after passing the town of Nia.

From Nia our next halt of any interest was at Sorghak, or, as it is locally pronounced, Sŏrrăk, which may be said to be the centre of the gold industry of this district. Though figuring in European maps, Sorghak is merely a collection of wattle-built semi-underground huts, dug in the soft loess soil. Some are regular caves. A more squalid place it would be hard to find; it has all the appearance of the mining camps which Bret Harte once familiarized us with, lack of water and an all-enveloping dust being its chief characteristics. The gold is worked by sinking narrow circular shafts, varying from 40 to 100 feet in depth. At the bottom of these a low tunnel is made at right angles to the shaft, 3 to 4 feet in height, and from 1½ to 10 feet in width. The tunnel is dug through shaly sand and gravel, in which occasional rock outcrops. Ten to twelve men, women, and children work each hole. Some of them handle the rickety windlass by which one is lowered into the pit, others pick out the soil at the bottom of the tunnel, while the remainder sift it over when it reaches the surface. Owing to the absence of water, the soil is not washed, but winnowed on exactly the same lines as is grain throughout the East. The final process consists in spreading the residue of the already winnowed soil on felts, then carefully blowing each handful over in search of gold. A more primitive method of extracting the most valuable metal in the world could not be invented. That which their forefathers, the Mongol Kalmacks, who are said to have first worked this district, did a hundred years ago, so the native Turki does to-day. What result might be obtained by the application of European methods to the Kuen Lun industry, I am unable to state with any exactitude. Though an exceedingly interesting question, it is perhaps one more suitable for the gentlemen who attend meetings east of Temple Bar than for those who have honoured me to-night.

Beside gold seeking, this portion of Turkestan boasts few industries. A certain amount of "charras," the hemp which is the main article imported by Central Asian traders *viâ* Yarkand and the Karakoram route to India, is grown in the bigger oases, but the other articles which go to make up the straggling trade that route enjoys, such as felts, embroideries, silk for underwear, and skins, chiefly come from the neighbourhood of Khotan, Yarkand, and Kashgar.

In vegetation the oases are exceedingly rich. As fine fruit, grapes, apricots, melons, and apples are grown as any in Kashmir, and Indian corn thrives in all of them.

One of the most striking physical features of this district may be studied in the numerous mountain streams and small rivers which descend from the Kuen Lun northern slopes, all to be absorbed sooner or later by the remorseless sands, against which nothing in nature seems able to compete. Between Sorghak and Achan, a hamlet from whence we again turned north towards Cherchen, these streams occur almost every few miles. Alike in general character, varying only in size, the description of one is that of all. At the immediate foot of the lower mountain slopes the stream has usually cut for itself a deep rugged channel with frequently almost perpendicular sides. In height the latter vary from 60 to 200 feet, and in the case of the bigger streams

CROSSING THE FROZEN STREAM IN THE KUEN LUN GORGES.

equally steep hills raise their rounded tops another 400 to 500 feet on either side.

The gorges are void of all vegetation, and are wild and rocky to a degree. The descent into them and ascent is at times difficult, being down a zigzag tract just fit for pack-animals. In volume of water there would seem also considerable variation in these streams, but this is mainly a matter of catchment area in their upper sources. As we crossed them in November they must have been almost at their lowest; most were dry or frozen up. Some carried a mere trickle of water, and the remaining three or four were never so much as a foot deep. When in flood, as occurs at the spring snow-melting, they become, on the contrary, wild torrents whose volume is plainly to be seen in the huge

boulders carried down, and the gravelly soil or worn rock which at times form their sides and bed. As the streams descend into the lower and more open slopes, the gorges diminish in depth and the beds open out. Before reaching the sand of the approaching desert, in most places a wide bare glacis composed of very fine gravel has to be crossed. This formation is locally known as Sai, and during the passage across it of such streams as are not already absorbed, the channels spread out, as is the case immediately south-west of Nia, to a width of, at times, 2 to 2½ miles. Practically there is no channel, the flood water pouring down in numerous wide shallow branches. The third and final stage in the life of these mountain streams is reached when those which remain enter the sands of the desert proper, for their fate is then sealed. Local conditions enable some to continue the hopeless struggle a little longer than others, but the tombstone of all, if it may be so expressed, is eventually a marsh where only the last signs of dead and dying vegetation remains.

At Achan we turned north to reach Cherchen, in order to descend the Cherchen Daria, which we proposed to follow to the point where it enters the Kara Koshun marshes. Some slight variation had later on to be made in this plan, and after quitting Cherchen we left the river about halfway down to make for Chakalik, the main oasis of these parts, and so situated as to be of no little importance geographically. Cherchen is the Charchan of Marco Polo, and is referred to by him as the capital of a district of the same name where "there are numerous towns and villages." In the present century we are now beginning to inquire where all these towns and villages are, for Marco Polo has long been proved to be a truthful man, and we find, as Dr. Stein has shown, and is even now continuing to prove, that they have almost all succumbed to the slow but remorseless attack of the desert sands. Whether these latter will be found to cover the buried treasures Egypt and Persia have yielded remains to be seen, and is unlikely, but it may with confidence be said that they have yet to disgorge a wealth of historical and perhaps ethnological remains to the intelligent explorer with time and energy to give to such an enticing task.

The Cherchen of to-day is a mean place of one rambling street, 150 to 200 yards long, with some wretched shops representing the usual Asiatic bazar. The people looked poorer and more unkempt than at any previous village we had passed, and the whole oasis has only an area of some 6 miles by 3. Old Cherchen stood 2½ miles south-west of the present site. There are considerable remains, and close to them is an ancient yet clearly marked river-bed with all the appearance of having been formerly a channel of the Cherchen Daria. From Cherchen, in order to keep on fresh ground as far as possible, we kept the right bank of the river until we quitted it.

Between Cherchen and Chakalik the country traversed is composed

of low scrub and strips of decaying forest, with, nearer the river, miles of reed jungle in which semi-stagnant or salt lagoons frequently occur. Animal life was here once more met with. The Mongolian or Prjevalsky's gazelle were not uncommon. They are locally known as Juggran. Maral stags and wild boar are also common, and the season when the tigers are most in evidence was just approaching. North of the river the sand dunes of the desert are seen close to the left bank, where they rise to a height of 30 to 35 feet.

A feature of the right bank of the Cherchen Daria is the number of disused ancient river-beds we crossed. One we camped in had a depth of 15 to 20 feet, with a width of 90 to 120 feet. The banks were lined with splendid old Tograk trees (poplars), whose age must, from their appearance and native tradition, run to hundreds of years. Sven Hedin has remarked upon the possibility of deducing the time when these channels held water from the age and state of decay of these giant trees, and no doubt they can and should help to determine such questions. What is perhaps of more interest is the fact that the Cherchen river, which still continues to flow, has in times past so often changed its channel, for after-experience proved to us that the marshes and lake-beds of this region have undoubtedly done and are still doing the same. The interest connected with this fact is chiefly based on the effect it may have in throwing additional light upon the yet unsettled problem of the situation of Lob Nor itself.

Even were time available to-night, the subject is one I should hardly venture to touch upon, so entirely has Sven Hedin in later years made the subject his own. The opinions of Prjevalsky, Richthofen, Kozloff, and others are well known, but in view of the scientific interest involved in the question of the inconstancy of all water channels in this basin, I may perhaps be allowed to quote one other case.

About lat. 94° E., on the Chinese side of the Kum Tagh desert, we explored a wide expanse of lagoon and lake known on our maps as Kara Nor. Here all the signs necessary to substantiate the inconstancy of such areas are very clearly marked. No two people who have examined Kara Nor and its ramifications would disagree in saying that both in area, depth, and actual position it never, for any length of time, remains constant. I venture to think no one who has seen that district, and is acquainted with the minute proofs to which Sven Hedin has put his theory, will again deny that not only Lob Nor, but the whole Kara Koshun basin wherever small lagoons and depressions exist, is in the same state.

It has been said that the geographical position of Chakalik is one of some importance, and a glance at the map will make this plain. The village, for it is no more, stands at a point where four routes meet, and though the traffic on any one of the four is insignificant, as we count it in Europe, it is none the less steady, and each track serves, as all tracks

in the East do, as a means of disseminating information slowly but surely over very wide distances. The first and most important is kept up between Chakalik and Urumtsi, the capital of the Hsin Chiang. This track runs *viâ* Kurla down the Tarim river. The continuation of it south from Chakalik is equally important, as by it all the Buddhist pilgrims making for Lhasa from Central Asia enter Tibet over the Altyn Tagh.

While at Chakalik I met and talked with a traveller who had only twelve days before returned from Lhasa, where he had been as guide to a lama who had come from near Lake Balkash, in the Semipalatinsk province in Russia, to make the pilgrimage. Among other items of news from Lhasa, our friend told us that since the Younghusband expedition everybody there wore ammunition boots!

The other tracks from Chakalik are that by which we had approached that place, and a second, though one seldom used, continuing south and east to the Chinese border at Sachu. In addition to these four routes, Chakalik can be reached from China proper across the Kum Tagh desert, and this we had long ago decided to attempt. I have seen it stated, and believe it to be a fact, that the Chinese occasionally make use of this route. We had the greatest difficulty, however, in getting any information about it from the Chinese amban at Chakalik, who implored us not to attempt the desert crossing, saying that we should lose our lives if we did, and that the Korla-Urumtsi route was by far the safest. When, however, the amban saw that our minds were made up, he did all he could to help. He ordered the requisite number of men and camels to accompany us, settled the wages we were to pay, and, in fact, took general charge of the expedition.

Leaving Chakalik, we made for Abdal, a collection of reed huts or Satma, as they are called locally, where some fifteen families eke out a hard existence chiefly by fishing in the marshes. Abdal stands on the right bank of the Cherchen Daria, at a point where that river enters the Kara Koshun. The river is known locally as the Cherchen Daria, though it was described by an old man to me as uniting in itself the waters of four streams, viz. the Yarkand Daria, the Kucha Daria, and the Karasha Daria. Few more uninviting spots can be wished for than Abdal as we found it in mid-winter.

The approach from Chakalik is over a waste of sand-dunes and hollows covered with reed-grass. Dotted over the waste are bits of dead forest and huge root-heaps buried in sand. These mounds—like gigantic mole-heaps—are a feature of the southern edge of the desert, and are due to the action of the wind and sand on the vegetation whilst the latter was in course of being overwhelmed. Nearer Abdal the low jungle changes to open sandy hillocks devoid of all vegetation. Only the dead root-ends of brushwood stick up in a mournful way through the sand. A shallow lagoon, 2 miles wide, and various small lake-beds

show signs of lately holding water. The last 5 miles is across the most desolate, forsaken-looking waste imaginable; not a tree nor a blade of vegetation exists as far as the eye can reach. The surface of the ground must at certain times become a marsh. It is composed of rough heaps of mud and frozen earth. At Abdal the Cherchen Daria was frozen 5 or 6 inches thick. To the north, north-west, and north-east stretch the dreary-looking marshes with open bits of water which make up the Kara Koshun.

The crossing of the Kum Tagh desert appears to have been an undertaking even in the days of Marco Polo, at which time there is no doubt

ANCIENT REMAINS OF FORTIFIED POST (KURGAN) NEAR KARA NOR.

a highway of a kind did exist. Whether this highway ran *viâ* Leu Lan to Sachu, or further south, yet north of Lob Nor, is an undecided point. The description given of it by that wonderful traveller in the thirteenth century is chiefly confined to a mention of the unseen terrors and the evil spirits said to inhabit the desert. "Here," he says, "where its breadth is least, it takes a month to cross. 'Tis all composed of hills and valleys of sand, and not a thing to eat is to be found on it. . . . Beasts there are none, for there is nought for them to eat. But there is a marvellous thing related of this desert, which is, that when travellers are on the move by night, and one of them chances to lag behind or to fall asleep or the like, when he tries to gain his company again he will hear spirits talking, and will suppose them to be his comrades.

Sometimes the spirits will call him by name; and thus shall a traveller ofttimes be led astray so that he never finds his party. And in this way many have perished. Sometimes the stray travellers will hear, as it were, the tramp and hum of a great cavalcade of people away from the real line of the road, and, taking this to be their own company, they will follow the sound; and when day breaks they find that a cheat has been put on them, and that they are in an ill plight. . . . And sometimes you shall hear the sound of a variety of musical instruments, and still more commonly the sound of drums. So thus it is," he ends, "that the desert is crossed."

Quaint as the above reads, and little information as our traveller offers of the physical configuration of the desert east of Lob Nor, it will not be without interest to say that the remarks as to the sound of musical instruments and drums may have some foundation in fact, especially when we remember that the language he would use is that of the East, where slight exaggeration is considered an art, not a fault as in the West.

After quitting Abdal our route lay for a day along the edge of the marshes, everywhere frozen. To our camp that night on the edge of the ice weird sounds came floating from the marsh, which were, of course, nothing but the groaning and booming of the ice as it froze. Not being an Asiatic, I should describe it as the far-distant sound of trumpeting elephants, but Marco Polo's description is the more poetical of the two.

Between Abdal and Sachu the passage of the desert took us twenty-seven days. The chief difficulty is the lack of fresh water, but in winter this difficulty can to some extent be overcome by carrying ice. Not only did we depend on this at times for our water, but when there was no brushwood or not sufficient to enable us to make a fire to melt the ice for them, the animals were also fed on lumps of ice broken small, if fed is the right expression. The other difficulty is the lack of adequate grazing, and it was due to the want of food as much as to the general exposure that our animals began to succumb before we reached the farther edge of the desert. From the point of view of physical geography, the eastern end of the Lob Nor basin offers most interesting and convincing evidence of the theory that the whole basin was once a vast inland sea.

In the desert two days' east-north-east of Abdal our track struck the foot of sandy cliffs having buttress-like faces fronting to the north 35 feet in height, covered with gravel on the top. Along the foot of the cliffs runs a narrow strip of reed vegetation 30 to 40 yards wide, in which marshy spots are found, the water sometimes fit to drink, but usually not. After following the line of cliffs for a day, our guide struck away from them north-east into the bare desert, where there is no sign of vegetation, the surface being of the nature of the bottom of a pond

frozen hard as it dried up. It stretches thus to the horizon, except towards the east, where as far as the eye can reach the cliffs appear to run on.

On the following day our track once again ran under another line of cliffs, of the same kind as the first, but more to the north and higher, their scarped front being in places 60 feet above the desert. Continuing along the base of this second sea-shore, the cliffs became gradually less regular. Isolated hillocks like islands pushed themselves forward out into the desert, and later the same day, having quitted the shore-line and followed a course east-north-east, we once more struck a third and equally well-marked sea-coast, but this time our course lay along the top of a line of cliffs almost identical with the two previous ones.

On Christmas Day, 1905, our camp was pitched under a steep bluff in the face of the cliffs. As it happened, the formation of the various sand strata composing the cliff-face was very clearly marked at this spot, so our holiday was spent in making a careful section of the exposed face. For the next two days we maintained the same direction, viz. north-east and east-north-east uniformly, every day more strongly confirming the impression that we were travelling along the southern shore of some huge island sea. So strong is the impression, that it is impossible to describe this portion of the desert in any other language than that which would naturally be made use of were this the case. On the tenth day from Abdal, the character of the sea-shore begins to change somewhat. The lines of cliff give place to stony ridges, with here and there rock outcropping. The ridges, like the cliffs, are not of loose sand, but are of hard-pressed clean-cut sand, as if built. The surface of the desert here resembles a field which has been newly steam-ploughed, then frozen hard. The going is as bad as it could be.

Here for the first time since Abdal, the boundless horizon to the north was broken in the far distance by an indistinct line of hills. In this part of the desert water is an even greater source of anxiety, as we had invariably to dig for it, sometimes as deep as 8 to 10 feet. The result was usually a few inches of liquid of a kind, and for that, when it came, we were thankful. At other times good water-holes were discovered, one of the best on the last day of the old year, and as there were also some reed-grass and dried-root heaps, we decided to rest the animals on New Year's Day. Though in itself an insignificant matter, the formation of these dried heaps is of the utmost importance to travellers in the desert, for they afford the only fuel obtainable. The root-heaps near Abdal already referred to are found on a much smaller scale in the desert, and I venture to offer the following theory of their formation: They may be said to exist where marshy spots or springs are or have once been. Each bush drops its fronds, when dead in the autumn, directly into its own roots. This continues year after year, and each storm, or even the

ordinary high winds, blow the sand more and more into and on to the bushes. As the sand covers the fronds heaped at the roots and mixes with them, it so gradually turns them into the bush sand-heaps, which, while the bush still lives, have only the tops showing. When the bush is dead and the ceaseless struggle with the overwhelming sand is finished, the latter spreads over the top of the bush, from which, if one digs into it, roots may yet be brought up to form excellent fuel.

After the rest to our animals on New Year's Day, I was able the following one to temporarily quit the caravan and ride to the base of the northern range, the approach to which was found to be of the same character as that to the lower Kuen Lun ridges further west. The range itself rises precipitously to a narrow rugged ridge, and is composed of hard clay or mud, probably with sand below. There is no vegetation whatever. The general average of the range was under 800 feet above the level of the desert. The direction lies east-north-east to west-south-west, and it can only be one of the southern ridges of the Kuruk Tagh, but which, such maps as we possessed of this region led us to suppose, did not come nearly so far south.

After passing this spot, clay terraces and isolated hillocks, which have all the aspect of ancient ruined cities, but are really mounds of clay, become the feature of the desert on all sides. These mounds are of the most fantastic shapes, and have been worn into such resemblance to ruined walls, towers, and gateways that, even close at hand, one at first imagines they represent the ruins of long-lost settlements. The surface of the desert now consists of a series of depressions, separated either by rolling ridges of hard fine gravel, or divided from each other by clay terraces. Under the firm gravel the soft sand is still to be found, with a few sand-heaps dotted about. The faces of some of the terraces are cut into curious shapes by the action of the wind. In one place the northern side has been worn into a line of what looked exactly like gigantic tombstones.

Twenty days from Abdal we camped by a good water-hole in one of these local depressions, finding, much to our surprise, a clearly marked ancient river-bed, in which were a quantity of growing reeds and some brushwood. Leaving this camp, we were again astonished by suddenly coming upon an ancient watch-tower, or torla, the first sign that we had struck one of the old historical highways which are known to have been kept up by the Chinese centuries ago. A few miles east of this point, in lat. 40° 21′ 37″, commences what has been, and may at any time again be, the western end of Kara Nor, the lake already referred to.

The night we reached the edge of this lagoon was, unluckily for us, marked by one of the terrific storms locally called kara buran (black storm). We had turned in after a long march on foot, and were hardly into our bags before the storm broke over the camp. Anything like the force of the wind we had never before experienced.

Luckily, the tents were under a gentle rise, and made fast fore and aft to some small trees; the pegs, also, as was our custom, were anchored down by the yakdans placed on top of them. For five hours the tents swayed and rocked like boats at sea, threatening every moment to be blown clean away, and all that could be done was to cling tightly to the front pole, hoping that the additional weight might prevent the final catastrophe. The storm burst in mad gusts about 9 p.m., blew its hardest about 10 p.m., and, as we foolishly imagined, appeared to be subsiding at 11 p.m. Feeling the wind going down, we ventured to quit the tent-poles and to exchange confidences as to the damage so far as we could make ourselves heard. Hardly had we crept back into our

A NATURAL CLAY TOWER IN THE KUM TAGH DESERT.

rugs and gone off to sleep when we were once more awoke by the same terrific gusts and wild shaking of the tents. There was nothing to be done but to jump out into 25° of frost and again hang with all our weight on to the tent-pole. For another two and a half hours the gale raged, until we almost began to despair of keeping the wind out. Had the door-fastenings given, or one gust managed to get in, the whole tent would have gone. Luckily, neither of these things happened, and by half past 2 a.m. it was safe to creep back once more on to one's rugs, and this time for what was left of the night. Waking in the morning, there was no sign of wind or storm, and but for layer upon layer of fine sand which had penetrated everywhere, the whole kara buran might have been a nightmare.

In the morning we explored the lagoon, finding along its southern border the remains of another ancient watch-tower, one of a series of four visible from that point. The watch-towers are some 2 miles apart, well placed to be seen, and on a line nearly west and east. The first watch-tower is built of mud or clay bricks, between which are layers of reeds. It had a base some 30 feet square at the bottom, and 15 feet at the top. The entrance must have been by ladder, or, as is still seen on the watch-towers in north-west Kan-su, by a very slender stairway up one wall outside. This stairway is also of brick, but can be destroyed in a few minutes once the defenders have mounted.

Five miles to the north of the lagoon the spurs of the nearest Kuruk Tagh can be seen. During the following day, having crossed an undulating wind-swept plateau covered with fine gravel, we dropped as usual into a depression, in which has been and now is at times a lagoon. At the south-east end we came upon the ruins of an ancient fortified post (or kurgan). The walls are built of small clay or mud bricks, and are still 14 to 16 feet thick. It had two entrances, one to the west, another to the north, and was roofless. The walls were 20 to 25 feet high, and were once probably higher. The post is of wonderful solidity, and in its day must have been impregnable.

Later on the same day another kurgan was discovered, but this was of larger dimensions, and probably held a permanent garrison. The remains of the double walls are 80 yards long by 50 wide outside, the inner walls being some 30 feet above ground-level. The site overlooks a wide-spreading lagoon 8 to 10 miles in extent, the bed of which held little water, being filled with reed-jungle and clay mounds.

For the last few days in the desert our route lay over the same kind of country as that already described. Even right up to the border of the oasis surrounding Sachu vegetation is exceedingly scanty, and the first sight of trees, luxuriant to us after the last month, was a real treat. Sachu is an ancient Chinese settlement said to have been planted as an outpost against the marauding Hung nu, or Huns (?), as early as the first century A.D. It was originally called Tung Huang, and is at present known locally by no other name.

From Sachu to the Great Wall at Chia-yu-kuan, the ancient frontier of China, took us twelve days to march. Here the final portion of the journey commenced—that through China proper. Though still three months from our destination, we were for the first time for six months in touch with civilization in the shape of the telegraph. From here to Lan Chou, the capital of Kan-su, the main great north-west road from Peking to Kashgar was traversed. The country, though sparsely settled, is of considerable value, being well adapted for pastoral use. Unfortunately, the Chinese are not a pastoral people, being essentially agricultural, so that it is unlikely that any large immigration will take place.

The mineral value of this portion of China is considerable, and I venture to prophesy that in the not far distant future it will make a name for itself as one of the richest coal and oil districts in the country. At present its future exploitation, from the point of view both of trade and mineral wealth, depends entirely upon the construction of a railway.

This strip of north-west Kan-su is, in its physical aspect, a continuation of the series of oases which border the desert along the northern base of the Kuen Lun range in Chinese Turkestan. Its streams, such as they are, partake of the same character as those already described in the latter country, that is to say, they are snow fed from the Nan Shan range and its offshoots, and are of variable volume, with a short course which ends in absorption in the desert to the north, or they are merged in the waters of the only two rivers deserving that name, the Hei Ho and the Yellow river. The main watershed dividing these two streams is formed by the Wu-shi Ling, a pass just under 10,000 feet in height, which presents no serious difficulty even to wheel traffic.

On the southern side of the Wu-shi Ling, a marked difference is to be seen in the agricultural wealth of the country. From the Wu-shi Ling to Lan Chou, in a minor degree, are found all the characteristics common to the more settled provinces of China. Here the population per square mile at once begins to increase. Villages are more thickly planted, and the general aspect is one of agricultural comfort.

From Lan Chou to Tai-yuan Fu, in Shan-si, our route lay through a little-known part of China. We crossed Eastern Kan-su Shen-si an Shan-si provinces, between the 36th and 38th parallels of latitude, visiting villages and old towns where Europeans had in some cases never before been seen. The area traversed consists of a series of plateaux in the heart of the loess country of North China, whose average height above sea-level is nearly 4000 feet. As is well known, the loess country is a most fertile soil, but more than any requires water, and that without fail. The districts traversed, though thinly populated, support a larger population than is usually supposed, and afforded a surprise in the character of the country, such as must be seen to be believed.

A study of the loess formation of Northern China would afford sufficient matter for more than one paper such as this, and it is only referred to to-night in the hope of invoking some information upon what appeared to us a matter for surprise, nowhere having previously seen any reference to such an extraordinary change in the character of the loess soil. The arid aspect and monotonous lack of natural vegetation common to all such districts is well known. Traversing the intricate network of valleys and stream gorges, between which are the plateaux characteristic of this part of Northern China, we had reached the border-line between Kan-su and Shen-si.

Beyond the town of Ching-yang Fu we were suddenly surprised, in the course of the day's march, to notice the valley-sides and hills were

becoming covered with brushwood. As we ascended the valley up a small tributary of the Huan Ho, trees, grass, and undergrowth increased, and the face of the country began to change as though by magic. The stream had become so choked with brushwood as to be almost impenetrable, and though the effect was somewhat sombre owing to the foliage not yet being out, the relief to the senses after the unvarying drab-coloured hill-sides and terraces was most pleasing. Towards midday we had mounted some few hundred feet up a spur on to a main ridge, and from there the view to us seemed a fairy transformation. Impossible as it may sound, but for the lack of grass, it was easy to imagine one's self riding over the Surrey hills. A series of ridges and spurs divided by numerous small valleys lay before us, all heavily clothed with trees and thickets of thorn and other scrub. As far as could be seen around, the whole district appeared similar, and it was easy enough to believe now the stories we had heard a few days previously at a tiny Catholic mission station buried in these wilds, of boar, deer, panther, pheasants, and game of all kinds. The existence of this mission was quite unknown to us, and it was by accident only that we did not pass without seeing it. Riding ahead of the caravan through the ruins of what had once been a picturesque village, Ma-Lin by name, I had paused to admire one of the lonely stone memorial arches so common in China. In addition to a low balustrade, the front of the arch pillars was faced with polished black stone, upon which was graven deep Chinese characters. From the tops of the fretted grey stonework hung small bronze bells, which the gentlest breeze sufficed to set tinkling.

Previous to entering the village we had passed the remains of a picturesque old temple, and no doubt the latter, as well as the archway, were both part of the same story could we have learnt it. Inquiry, however, as was usually the case, proved fruitless. In China, those able to do so are never anxious to tell the story.

As I was about to move on, my eye caught sight of a Chinese farm hand, and on looking at him again I was astonished to see in his mouth a distinctly European pipe. At the same moment I noticed, over the doorway of one of the courtyards, a small cross. The mystery of the pipe was soon explained. In answer to my question, the owner of it led the way into the yard, on the other side of which stood a tiny chapel, from whence, as we entered, one of the two brothers in charge was just emerging. Mutual introduction followed, and we were soon enjoying the limited but unstinted hospitality the little mission afforded. Buried in the wilds of Kan-su, this has been established for fifteen years. So far as the two brothers were aware, it had only twice before been visited by strangers. In one case the traveller was the well-known mission leader, Dr. Martin; in the other it was the Russian explorer Obrutchev.

Thanks to the artistic powers of a former brother, the mission possesses a perfect gem in its miniature chapel. Inside it is profusely ornamented with scroll paintings of no mean merit, and these, with the carved woodwork in which Chinese carpenters excel, and some imported lanterns, give to its interior an aspect of tender care wholly in keeping with the character of the devoted men who are content to spend their lives out off from civilization.

After bidding farewell to our hosts, we crossed into Shen-si province, and made our way over one watershed after another by hill tracks until we struck the valley of the Lo Ho at Fu Chou. Up this we turned to Yen-an Fu. A curious feature of this district is the cave tombs to be seen here and there cut in the solid rock. That they are or were temples I believe to be the case, though I am aware that during the terrible days of the great Mohammedan rebellion many caves were used as hiding-places by the wretched inhabitants.

From the solidity of the work, and in one case from a curious kind of sarcophagus which we saw in a temple, I am led to suppose that they are Buddhist remains. That Buddhism still flourishes is shown by the temples in daily use. Most picturesque some of these are, and I was fortunate to be the witness of a quaint scene at one of these lonely spots. A little temple stood perched on a rocky bluff some 40 feet above a small stream having at its back a steep thickly wooded hillside. As I rode past on the narrow winding track, a respectably dressed farmer had just arrived, either to return thanks for some favour or to ask a boon from the little gilt figure of Buddha, which sat enshrined in the usual attitude. Having dismounted, the farmer produced from his saddle-bags six large dough-cakes, an offering which visibly caused the mouth of the old priest to water, and as the latter, an old man, kept solemn time beating a small brass incense-pot with a tiny mallet, the farmer made his prayers and his adoration on his knees. Holding in one hand a lighted fire-stick, he lit two small pieces of tissue-paper which lay in his right palm, then gently allowed the burnt ashes to float away. Rising from his knees, he turned to me as I sat outside on my mule, and politely asked if the noise of crackers would frighten the animal, at the same time holding up a joss-packet which he took from a table by the door. As the mule was standing on the very edge of the bluff above the stream, I replied that probably it would, so he quietly bade me depart, and I went, but for the rest of the day I could not shake from my mind the idea that in the simple ceremony just witnessed perhaps the key was to be found for the regeneration of this vast empire, which before everything requires a firm and honest belief in some moral faith.

Near Yen-an Fu the first signs are met with of the vicinity of the huge coalfields which cover Shan-si and stretch well into Shen-si. Petroleum is also found 30 miles from the town. Yen-an Fu, like Ching-yang, is merely a skeleton of what it once has been. Ichabod is written

large over all these towns, which have never rallied from the years of continuous warfare which the first Mohammedan rebellion inaugurated. It stands on a small tributary of the Yellow river, the Fu Ho. None of these streams are navigable, not even the Lo Ho, which we had crossed at Fu Chou, although at certain seasons the water is deep enough to allow of the passage of the flat-bottomed ferry-boats in use on the Yellow river. Most of the streams are too winding and the mud-banks and shallows too frequent to make it worth while to attempt navigation.

Leaving Yen-an Fu, we struck north-east across a local watershed to Yen Chuan, a small town standing on the Hsia Ho, a tributary of the Yellow river. The approach to the latter is through a most intricate network of small ravines and rocky gorges, though still the general character of the country is loess. At the point we crossed the river by a ferry is the tiny village of Yen-shui-kuan. The left bank has a precipitous cliff of rock 180 to 200 feet high, the right being much lower, and from it broken low hills run back, under which the village nestles at the water's edge. The river is 300 yards wide and flat bottomed; plank-built boats carry on the local traffic down-stream.

The western half of Shan-si province is similar to the Shen-si country, that is loess, but with the unusual red-coloured formation occasionally showing up. This is said by Richthofen to occur where the loess lies in greatest thickness, its lowest portions then being of a reddish colour. Once across the Yellow river, the traveller finds himself gradually approaching a veritable black country, where coal, and coal alone, occupies the lives of three-quarters of the population.

Historically, Shan-si province may be said to represent the home of the Chinese race. As early as B.C. 2255, the people of Meaou, who were the inhabitants of what is now called Shan-si, are mentioned in the Chinese classics as being in a state of rebellion. From the same source, we know that the Yae-Yuan plain mentioned as being "set in order" after a great flood (probably the flood referred to in the Christian Bible) is that portion of the present Fen Ho valley between Fen Chou and Ping-Yang in Shan-si.

At Fen Chou the main highway from Sian Fu to Tai-yuan Fu was reached. The town lies at the north-west end of the Huo Shan, a high range which is the dividing-line between the anthracite districts of Eastern Shan-si and the bithuminous portion of the province lying mainly to the west of the mountains.

Tai-yuan Fu, the capital of the province, lies on the left bank of the Fen Ho, and is chiefly known to ill fame as being the scene of the most cold-blooded and brutal murders of European missionaries in 1900. Between Tai-yuan Fu and Cheng-ting Fu, the latter a station on the Lu-Han railway which connects Peking with Hankow, some of the richest coal and iron districts in the province are to be found; anthracite coal of the very best kind is mined in unlimited

quantities, and the strings of donkeys, each laden with two enormous lumps of coal, are a feature on the abominable track over which most of the trade into Shan-si still runs. That this historic route will soon become a thing of the past is probable, for a small branch line has even now penetrated halfway to Tai-yuan Fu, which Belgian interest is responsible for. It is hoped that the capital of Shan-si will be reached in another eighteen months.

Finding the railhead at the small town of Ching Hsing, just inside the border of Chili province, we gladly exchanged our nine months of methodical daily tramp for the speedier and more modern method, and in forty-eight hours found ourselves in Peking.

Before the paper, the PRESIDENT: I have to introduce to you Major C. D. Bruce, who is addressing our Society for the first time to-night. I shall not, of course, say anything about his last interesting and, to a large extent, novel journey through Asia from Leh to Peking, because his paper will speak for itself, but I will say a few words as to his previous career in the Far East, which made preparation for that journey. Major Bruce went out originally to Wai-hei-wai as second in command under Colonel Bower—who is here to-night, and I hope will speak later of that Wai-hei-wai regiment of which we used to hear so much, but which no longer exists. In 1900 he went with the regiment on the Peking expedition, and was severely wounded in the attack on Tien-tsing. Since that time he has been travelling largely in Asia. I need not give you the details; but it will interest you to know you are not listening to a neophyte in the ways of the East. I now call upon Major Bruce to give us his paper.

After the paper—

Sir THOMAS HOLDICH: Major Bruce has taken us into a part of the Eastern world with which personally, I regret infinitely to say, I am unacquainted; consequently, I am able to offer but little criticism on the admirable paper he has just read to us. I have just a word or two about the loess formation to which he has alluded, which may be interesting. So far as I know, where I have travelled in Central Asian districts, loess formation is to be found on the northern slopes of all the principal ranges running east and west throughout the country, and I have long ago come to the conclusion that the formation is due partly to wind action (especially to the extraordinarily forcible north-western winds which obtain all through high Asia), and partly to detritus washed down from the hills during the season of flood. That undoubtedly is the condition of the loess which we find on the northern slopes of the Turkestan ranges, and although I am quite unacquainted with the part of Asia which Major Bruce has been describing, I cannot help thinking that the same great forces of Nature produce the same formations which he has encountered. There is, however, another point to which Major Bruce has made allusion to which I should like to call your attention. He has recognized, in a most generous way, the admirable assistance obtained from one of the native surveyors, who was attached to his party from the Survey of India. Now this, I am glad to say, is nothing new, for I think every explorer who has been assisted by these surveyors lately has invariably borne the same evidence to the excellence of their work. But at this time it is with new interest that we regard this matter, for we are approaching a new phase of geographical exploration. The old age of pioneer work has passed away, and we must now, when we set to work to wander through new countries (as Major Bruce has done), make use of more or less trained

agency to assist our observations as simple travellers. With the enormous field that still lies before us in various parts of the world, I conceive that we shall never arrive at the solution of the great problem of mapping the world successfully without some such agency as this. Well, it happens that the Colonial Committee have lately issued a Report on Surveys in another part of the world, *i.e.* in British Africa. It is a most admirable report, and will be, I am certain, of immense interest to all those of you who are interested in that country. In that report they have described the success which has, so far, attended efforts to train the natives of Africa as the natives of India have been trained in Survey duties. Taking it on the whole, I regret to say that the reports are not altogether favourable. With the single exception of Lagos, I do not think there is any one report which might lead one to hope that in future great success will attend these efforts; but I would like to warn those who are interested in the matter, that it is far too soon to arrive at any conclusion on the subject. If you will for an instant consider what the process is by which men, such as those to whom Major Bruce has alluded, arrive at the skill which they attain as surveyors, you will, I think, agree with me that it is a long process, and a laborious process, to attain such an amount of technical knowledge as they acquire. In the first place, in India, the men whom we get for this duty are drafted from all sources, both civil and military; and you must remember that from the very beginning they are well-educated men. We do not deal with quite such raw material as they find in Africa. The African schools have not yet arrived at the position of turning out men whose education you may consider as thoroughly sound when they are selected for survey training. In India, having got the men specially selected, in the first instance, they are again subjected to a process which we might call a process of natural selection, until finally, after some years' experience, they are drafted into the Survey Department for a further five or six years' severe training before they can take the field for such work as Major Bruce has described. All this, as you will easily recognize, is a matter of time and patience and infinite trouble; but I have every conviction myself that they will eventually find in Africa men quite equal in intelligence to any that we find in Asiatic fields; and I firmly believe that if they are to solve the gigantic problem of mapping the continent of Africa rapidly and cheaply, it will be through native agency; but only after the application of infinite toil and patience in training shall we succeed in getting the men we want.

Colonel Bower: Major Bruce has modestly talked of himself as an unscientific explorer. I do not think it is possible for any man to visit Chinese Turkestan and leave it without certain feelings of lost opportunity. My own feelings, when I was there, were that one day I wished I had been a geologist; another day, a linguist; another day, a naturalist; another day, a botanist, and so on. No one man can come away able to do more than simply give a good general description of what he has seen, as Major Bruce has done this evening. I agree with Sir Thomas Holdich that it is now the time for specialists.

I have heard the theory advanced that the population of the world has not so much increased, but that centres of population have changed. If there is anything at all in that argument, the strongest point in its favour is the existence of Chinese Turkestan, where you have a country nearly all desert, with an oasis here and there, yet under that desert we know there are the remains of innumerable towns and villages; and then away to the north there are also cities under the ground; hills with tunnels, and in those tunnels rooms and houses. Obviously they were occupied by a different people from those who lived in houses in the plain now buried under the sand. We have every proof there were many races and many languages there—we find traces of them. It is a great field for scientific research.

Major Bruce alluded to the water-channels changing their course. Undoubtedly they do; and, what is more, I think there are subterranean channels there that also change their courses. On the north of the Tarim river, I was travelling through a forest of tagrak trees (poplar), when suddenly I stepped out from living into dead trees, and the whole day marched through dead trees with every twig perfect. It is a very difficult thing to account for; apparently they were all struck dead on the same day. The only thing I can think of is that they were nourished by some underground water that had suddenly changed its course. Major Bruce mentioned the lakes that had different levels, and were apparently shrinking. My experience in Tibet was that nearly every lake showed obvious signs of at one time having been very much larger.

Captain Deasy: The paper which has just been read to us by Major Bruce is of special interest to me, because I have made three expeditions into Tibet and into the adjoining country, and I would like to remind you of several problems which still remain unsolved. One of these is the course of the Khotan river from the source down through the Kuen Lun range, considerably to the west of where Major Bruce went. Another, of a different nature, and one to which Major Bruce has alluded, is the problem of the origin of the gold-supply of Central Asia. There is, undoubtedly, a good deal of gold to be found there. It has been of special interest to me to hear that Major Bruce has found another route from the south of the Kuen Lun range into Polu. It bears out, I think, the statement which has been made by a good many travellers, that there is no caravan route either from Rudok or Lhasa into Polu and Chinese Turkestan. I have been constantly told that in days gone by there was a regular trade route from Lhasa into Polu, and I made every endeavour to try and verify that statement, but without success. We cannot regard that route by which Major Bruce went to Polu as a trade route. He has alluded in a very brief manner to the difficulties of the journey, and glossed them over in the course of a few words. But I can assure you that the difficulties which he has had to encounter, especially in that part, have been exceedingly severe; indeed, far harder than you would think from listening to Major Bruce this evening. I am very glad to have heard the remarks which Sir Thomas Holdich has made concerning the assistance which I think nearly every British traveller in Central Asia has had from the Survey Department of India. Sub-surveyors, all of whom are highly trained, are always ready to volunteer to accompany any British officer, or any Britisher, into no matter what parts of Central Asia. When the history of the exploration of Central Asia comes to be written, I sincerely hope we shall find adequate credit given to the Indian Government, and more especially the Survey Department of India, for all the valuable help and assistance they have given to geographical research and science in Central Asia.

Captain Neill Malcolm: I am afraid I can add very little to what we have heard this evening, because the route which I took with the late Captain Wellby, whose name will be remembered by many Fellows of this Society, differed a great deal from that of Major Bruce, because, although we started from Leh and went to Peking, we only touched his route at the Lanak La and at Lan Chou, but I can corroborate what he has told you about the solitude of Tibet and the sense of the insignificance of man, since for four and a half months we did not come across a dwelling of any kind. You can thus see that I can add but little to your knowledge of the part of the world Major Bruce has described this evening. The only thing I should like to talk about is the question of native surveyors to whom Sir Thomas Holdich has alluded, and the possibility of our using them in Africa. I, like every other traveller in Central Asia, owe much to the native surveyors of

India: and if we are going to do anything of the kind in Africa, the people to whom we might turn for help are, I think, the Baganda. The ordinary native of Africa has a glorious indifference to detail at any time. He cannot understand that it matters whether you call a lake by the same name as a mountain, or a mountain by the same name as a lake. But with the Baganda it is rather different, for they are naturally intelligent, and appreciate anything in the nature of book learning. As far as I know, they are the only people of Africa who do so, and if there is going to be a survey department, they are the people with whom we might possibly begin.

After some remarks by Captain Turner—

The President: I must for once depart from my usual reticence in the chair and criticize one part of the discussion—Captain Malcolm's statement about the Baganda. He used the phrase that they were the only African race who loved a book. Now, oddly enough, that was the very phrase that H. M. Stanley, who knew the Baganda well, used years ago in speaking of the Hausas. I cannot allow the credit of my beloved Hausas to be taken away as the only African people who, for many centuries, have produced books—history, romance, poetry. Now I have to ask you to give a hearty vote of thanks to Major Bruce for his very able paper.

Major Bruce: I have to thank you very much indeed for the kind attention you have given to my paper to-night, also those gentlemen who have been good enough to offer the few but very interesting remarks they did—Sir Thomas Holdich, Colonel Bower, Captain Deasy, and Captain Malcolm. I do not wish to detain you any further. I have only to thank you once more for your very kind attention to me.

A SHORT ACCOUNT OF THE RUSSIAN HYDROGRAPHICAL SURVEY.

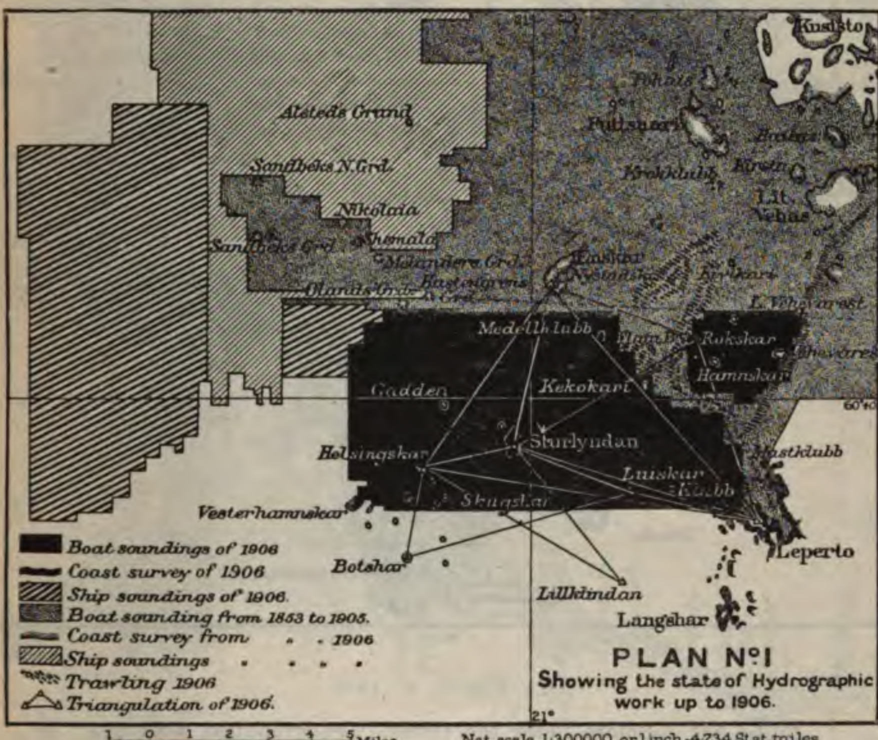
By J. de SCHOKALSKY, Colonel of the I.R.N., Hon. Corr. Member of the R.G.S., President of the Section of Physical Geography of the Imperial Russian Geographical Society, St. Petersburg.

The beginning of the Hydrographical Survey in Russia was contemporaneous with the greatest change in the destiny of the Empire, the time of Peter the Great. This Tzar, the first who assumed the title of Emperor, ordered various hydrographical work to be done, necessary in connection with the navy, the foundation of which is also one of his glories.

At first the administration of the hydrographical survey depended solely on the Tzar. He himself chose from the officers men suitable to undertake this work, and indicated where the surveys should be made. In 1724 the Tzar ordered the Admiralty Board to give instructions, drawn up by this administrative body, to the officers charged with the survey of the Gulf of Finland. Later this practice became the rule, and the direction of the hydrographical survey was made the duty of this board.

The first chief hydrographer was A. Nagaef, captain in the navy, who, by the order of the board, had made a study of hydrographical

surveying. The first naval charts were printed in the naval press, which belonged in the year 1752 to the Naval Academy, and afterwards to the Naval School. Under the Emperor Paul I., it was constituted a Committee for the extension of naval science and for the improvement of naval practice, under which was included hydrography; but this committee existed only till the year 1805, when the Imperial Admiralty Board was founded (Gosudarstvennui Admiralteiski Department) under the direction of the Minister of the Navy. The purpose of this



board was to ensure that the hydrography of Russian waters should be as perfect as contemporary knowledge could make it. In January, 1824, this board was abolished, and in its place was established the Administration of the Chief Hydrographer and the Committee of Naval Science, the former being only occupied with hydrographical work.

The first and only chief of the administration was Admiral Saruchef, and his *aide* was Lieut.-General Schubert. After the death of Saruchef the administration was carried on by a Hydrographical Department, which twenty years ago was named (in 1884) General Administration of Hydrography.

After the preceding short account of changes in hydrographical administration in Russia, we can now consider our principal theme—the hydrography of Russian waters.

OLD PERIOD, TO 1855.

Baltic Sea.—Before Peter the Great, "geographical drawings" so called, without meridians and parallels, were used in Russia in place of geographical charts. Evidently, therefore, the Russian navy at first used foreign naval charts. The first Russian charts of the Baltic sea were made at the end of the eighteenth century, and the first atlas of this sea is dated 1738; it was made by a naval officer, Soimonof. The second "atlas" was the work of the hydrographer Nagaef, and was published in 1757; this atlas was used for fifty years. The first really scientific hydrography began at the commencement of the nineteenth century, when the direction of the hydrographical survey was in the hands of General Schubert. He made the first triangulation of the Baltic sea, by which was ascertained the position (1828–1838) of 648 points on its shores, and in 1832 the chronometrical expedition was

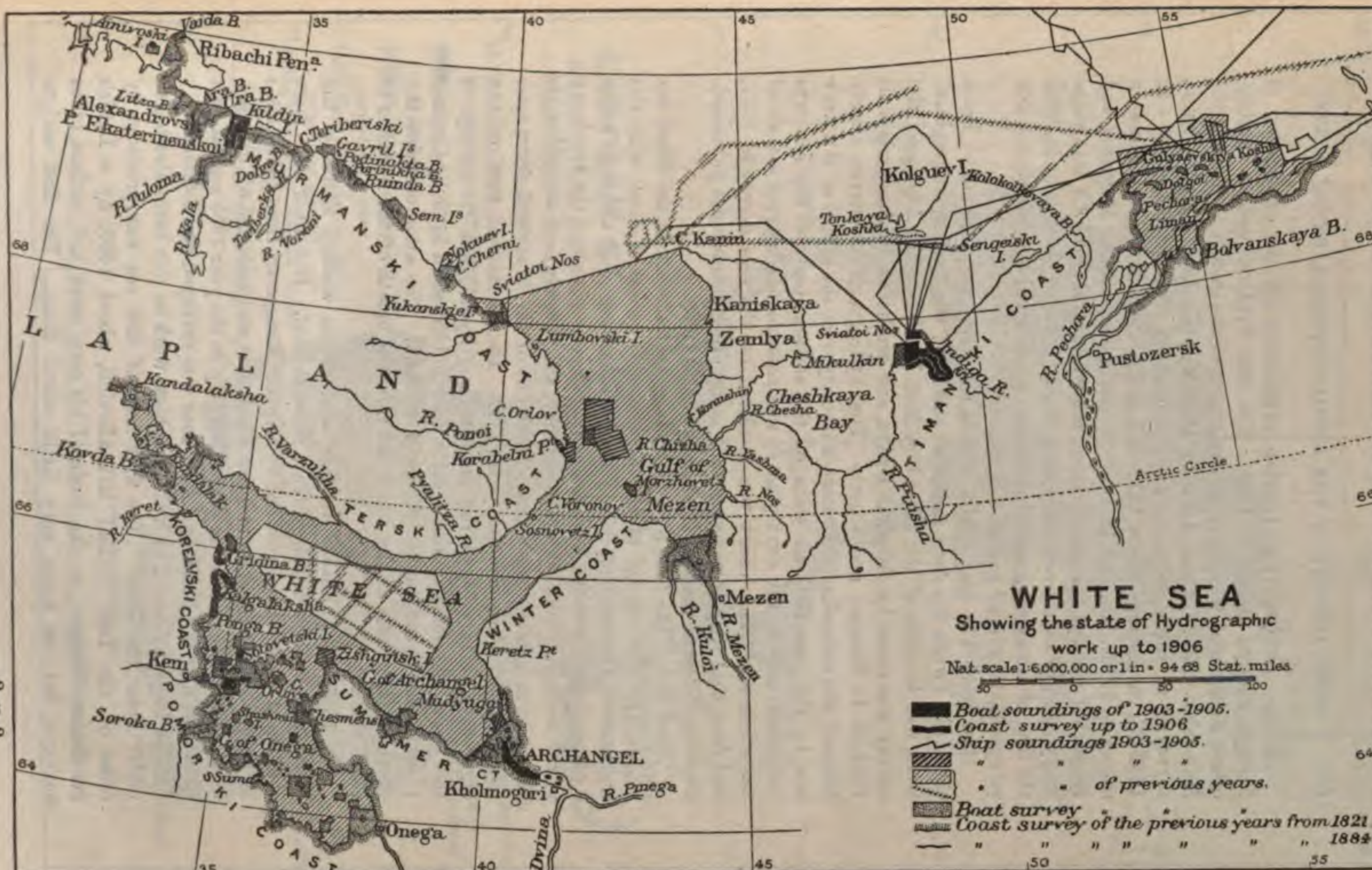

BALTIC SEA
Showing the state of
Hydrographic work
up to 1906.
Nat. scale 1:5,000,000 or 1 in. = 78·89 Stat. miles.
Boat soundings of 1906.
Coast survey of 1906.
Boat soundings of previous years
Coast survey of " "
Ship soundings " "
GULF OF BOTHNIA
FINLAND
SWEDEN
GULF OF FINLAND
RUSSIA
BALTIC SEA
Gulf of Riga
ST PETERSBURG
Kronstadt
R. Neva
Oranienbaum
Viborg
Fredrikshamn
Helsingfors
ÅBO
Kimito
Aland Is
Revel
Spithamn
Hapsal
Dagö
ÖSEL
Pernau
RIGA
R. Dvina
Windau
Libau
Memel
Polangen
GOTLAND
Farö
ÖLAND
Narva
Lovisa
Borgo

despatched with the duty of fixing the longitude of 72 points. Plane-table work was based on these determinations to a scale of 1200 feet to the inch, and many soundings were taken. By the beginning of the year 1855, 42,285 square versts of the Baltic had been surveyed.

White Sea.—The first survey in the White sea began after the death of Peter the Great. From 1727 to 1739 several naval officers surveyed some of its shores, the mouth of the Dvina, and the shores from Point Kanin to the Obdorsk, and further east. But all this survey, except the survey eastward from Cape Kanin, was made without any system, and the hydrography of the White sea remained very imperfect till the year 1797, when Major-General Golenischtef-Koutusof impressed upon the Admiralty Board the necessity of a general survey of that sea. This project was approved, the survey was carried on from 1798 to 1801, and the results published in 1806 in an 'Atlas of the White sea.' Many imperfections in this first work necessitated a re-survey of this basin, and the work was placed in the hands of Captain-Lieut. Reinecke in 1827. This hydrographical expedition was based on a true scientific system, and continued till 1832. The results were published in 1835 in an 'Atlas of Charts of the White Sea,' followed by a 'Directory' of the same sea and all the northern shores of Russia in Europe.

Siberia.—The shores of Siberia were surveyed firstly by the Great Northern Expedition, which was in operation from 1734 to 1741, and surveyed a long line of coast from Cape Kanin to the mouth of the Koluma river. The work of this famous expedition was described by me in the Notiee presented to the Eighth International Geographical Congress in London in 1895. From 1821 to 1853 many parts of the northern shores of Russia were resurveyed. The shores eastward of the White sea were resurveyed in 1826–28 by two expeditions sent by the Admiralty. The first consisted of two pilot officers, Mr. Pakhtussof and Berejnuikh. It started from Pustosersk, at the mouth of the Pechora, and surveyed all the shores from the islands in the delta of the Pechora to Kanin, taking soundings all the way.

The second expedition worked two years consecutively. Its leaders were two pilot officers, Ivanov and Ragozin. It also started from Pustosersk in the spring of 1826 towards Medinski Zavorot, in the Pechora delta, as this delta had already been surveyed in 1821–24 by the pilot officer Ivanov. After a survey of the isles lying near the shores of the delta, the bay of Khaipuduir, and the coast up to the southern part of the Kara sea, the expedition returned to Obdorsk to winter. In the spring of the next year the expedition started from Obdorsk towards the mouth of the river Baidarata, and from there it surveyed all the shores round the Yalmal peninsula. Along these shores the expedition determined the latitude of sixty-one places, the longitude of thirty-three, and the magnetic variation of many. Tidal observations were also recorded.


WHITE SEA
Showing the state of Hydrographic work up to 1906
Nat. scale 1:6,000,000 or 1 in. = 94.68 Stat. miles
Boat soundings of 1903-1905.
Coast survey up to 1906
Ship soundings 1903-1905.
of previous years.
Boat survey
Coast survey of the previous years from 1821.
1884
Ribachi Pen.
Vaida B.
Alexandrovsk
P. Ekaterinenskoi
Kildin
C. Teriberski
Gavril Is
Rinda B.
Sem Is
R. Tuloma
R. Kola
MURMANSKI COAST
Sviatoi Nos
C. Cherni
Lumbovski I.
LAPLAND
Kandalaksha
Kovda B.
R. Ponoi
C. Orlov
Korabelni Pt
R. Varzukha
Pyalitza R.
TERSKI COAST
C. Voronov
Sosnovetz I.
Gulf of Mezen
R. Chizha
R. Yashma
R. Nes
Mezen
R. Mezen
R. Kuloi
WINTER COAST
Keretz Pt
WHITE SEA
Gridina B.
KORELVSKI COAST
Kem
Soroka B.
POMORSKI COAST
G. of Onega
Onega
Zhizhginsk I.
G. of Archangel
Mudyugs
SUMMER CT
ARCHANGEL
Kholmogori
R. Pinega
Dvina
C. Kanin
Kaniskaya Zemlya
Sviatoi Nos
C. Mikulkin
Cheshkaya Bay
R. Chesha
Kolguev I.
Tonkaya Koshka
Sengeiski I.
Kolokolkovaya B.
TIMANSKI COAST
Indiga R.
R. Pesha
R. Pechora
Pustozersk
Pechora Liman
Dolgoi
Bolvanskaya B.
Arctic Circle

Novaya Zemlya.—The Russian expeditions for the exploration of Novaya Zemlya began in 1768. The first explorer was navigating-officer Rosmuislof, who surveyed some parts of the eastern shores and the Matochkin Shar. From 1821 to 1824, Captain-Lieut. Lutke, T.R.N., surveyed all the west shores and the channel of Matochkin Shar. In 1832–34, navigating-officers Paktusoff and Zivolka surveyed the eastern shores to 75° N. lat., and in 1838–39 navigating-officers Moiesseef and Rogatshof surveyed some parts of the western shores. Of late years many surveys have been made in different parts of these islands, with the idea of discovering harbours for ships approaching their shores, but no systematic survey has been organized.

Azov Sea.—The first charts of this sea were published under Peter the Great (when the Azov fleet was started); the first hydrographical work was an atlas of the river Don from Voronej to the Azov sea; the survey was made by Admiral Kruys, and published in Amsterdam in 1703-04 in Russian and Dutch. The hydrographical survey closely followed the extension of Russian authority over the shores of the Azov sea, in the year 1701 an atlas of the eastern part of the sea was published, and in the next year it was possible to construct a chart of the whole sea. This chart was re-edited by the new survey in 1771, and from that time to the year 1835 many other charts were published, showing different parts of the shores of this basin.

Black Sea.—The first Russian hydrographical work in the Black sea began with the voyage of the Russian man-of-war *Krepost*, with the ambassador Oukraintzef, from Kerch to Stamboul. But although many hydrographical surveys were made in different places of the Black sea in the course of the eighteenth century, till the reign of Catherine II. the chart in greatest use was a French one of the Black and Azov seas, published in Paris in the year 1772. In the second part of the eighteenth century began the more serious hydrographical surveys of this basin, and some of the results were published in 1779 by Captain Billings, an hydrographer of the first rank. The atlas contains the charts of the shores of the Black sea from the mouth of the Dniester to the Kuban.

In 1807 was published another atlas of the western shores of the Black sea, constructed by Lieut. Boudishtchef. But finer and more competent work was carried out by Captain Manganari from 1825–1836; he surveyed both the Azov and the Black seas, and collected all his work in an atlas published in the year 1842. Up to the year 1855 a great part of the basin of the Black and Azov seas was surveyed and sounded.

The Caspian Sea.—The hydrographical work in this basin also began under Peter the Great. The first map of this sea was produced by order of the Tzar Aleksei Mikhailovich, about 1660, by a Danish gentleman, Shatran, on the basis of his own work and various other surveys, but we know very little about them. The first serious

CASPIAN SEA
Showing the state of Hydrographic work up to 1906.
Nat. scale 1:7,000,000 or 1 in. = 110·46 St. miles
50 0 50 100
Boat soundings of 1903 to 1905.
Boat soundings of previous years.
Ship soundings of previous years.
Survey of shores from 1854 to 1874.
Shores approximately surveyed.
R. Ural
Guriev
R. Emba
R. Volga
ASTRAKHAN
Czarevitsa B.
Buzachi Penª
Fulali
C. Tub Karagan
Shemchushnyi Bank
Ft. Alexandrovsk
Chechen I.
R. Terek
Agrakhan B.
Petrovsk
Alexander B.
Kenderli B.
Derbend
C. Su
Kara Bogaz
(Black Gulf)
Apsheron
BAKU
Naphtha Bʸ
Krasnovodsk
Balchan B.
Usun Ada
Mikhaelovsk Bay
Chelekin I.
Ogurchinsk I.
Lenkoran
Chikishliar
Enzeli
Astrabad
Ashref
Hassanabad
Mt. Demavend

expedition, which surveyed the Caspian, commenced work in 1714 under the direction of Prince Bekovich, sent by Peter the Great with the special purpose of making a survey of the old bed of the Amu Daria. Bekovich surveyed the eastern shores of the Caspian sea close to the Astrabad gulf, and in his report to the Tzar confirmed the news that eastward from the Caspian there existed another sea—the Aral. On receiving that knowledge the Tzar immediately, in 1716, sent another expedition to make an accurate survey of the Caspian sea under the command of Lieut. Kozin, Prince Ouroussof, and Mr. Travine. The two first made the map of the eastern shores, and the last the map of the western shore. The continuation of this work was committed to Lieut.-Captain von Verden, with his *aide* Lieut. Soimonof and Prince Ouroussof. After a survey of two years (1719–1720), they obtained the geographical position of twelve points and a survey of the western shore from Astrakhan to Persia. Joining the previous work to theirs, they constructed the first approximately accurate map of the Caspian sea, published in St. Petersburg in 1720, under the title "Map of the Caspian Sea from the Mouth of the Jarkowski to the Astrabad Gulf" (Kartina ploskaya morya Kaspiiskago ot ustya Yarovskago do zaliva Astrabadskago). This map had certainly many defects; the longitude is not marked, the north-east point is too long, and the shores between Kenderly and the Gulf of Khiva is not plotted. In 1772 this map was presented by the Tzar to the Paris Academy of Science, of which he was a corresponding member. On this sheet, engraved by Delisle at Paris, the longitude of Astrakhan is given as 47° E. from Paris.

In 1772, during the Persian campaign, various surveys were made, and in the next year there was sent out a foreign officer, Bruce, who stated that he accomplished a journey round the whole basin of the Caspian and constructed a map of it, but there is no copy of this map now extant.

After the death of Peter the Great the Admiralty College ordered a new map of the Caspian sea to be made, because on the one made in 1721 by von Verden, the new provinces and many rivers had not been plotted. Lieut.-Captain Soimonof and Lieut. Dounine were commissioned to the Caspian sea, where they surveyed for two years, 1726–27. The geographical positions of six other places were obtained by astronomical observations; but their work was not found sufficient, and in 1727 Lieut.-Captain Mishoukov was sent to complete this work. On the basis of these surveys was constructed an atlas of eight maps, very roughly engraved, and published in 1731. A new and better map of the Caspian was issued by Admiral Nagaef in 1760.

The insufficiency of the existing knowledge of this basin necessitated, at the end of 1763, the sending out of another hydrographical expedition to make a new and complete survey of the Caspian sea. In the

beginning of 1763 the new expedition was formed under the command of Lieut.-Captain Tokmachev, with two young officers, Panin and Matveev, as assistants. In 1764 and 1765 they surveyed the eastern shores from the mouth of the Oural to the Astrabad gulf. This work was utilized by Lieut. Nagotkin to construct a new map of the sea, but he died before it was completed, and it was only published afterwards in 1796.

In 1787 another survey of the basin was made by Lieut. von Moller. In 1807 Golenistchev-Koutousov published at his own cost a new chart, which, with the chart of Nagaef and the atlas of Soimonof, was employed by seamen till 1826.

In 1828 the Government Admiralty Department ordered pilot officer Kolodkin to make a complete atlas of the Caspian sea, including one general map of it, and four special maps on a larger scale, and plans of some ports, gulfs, and roads. Kolodkin was at work from 1809 to 1813, and in 1826 was published this atlas, containing a general map, four special ones, a plan of Astrakhan, eleven maps of different ports, and two plates of sketches of the shores. This work is an improvement on the preceding, but as pilot-captain Kolodkin was very studious and conscientious, some of his astronomically determined points were not sufficiently accurate; for example, the position of the Isle of Chechen is 10 miles out, and that of Derbend 20 miles. All these defects were the result of a very insufficient supply of instruments at the disposal of the expedition, and of very bad relations between him and the commander of the ships of the expedition. However, this "atlas" was employed about thirty years, and with regard to the southern part of the sea it was sufficiently good. In the neighbourhood of the mouth of the Volga the bar changes very rapidly, because the river alluvium settles there.

With the intention of preparing new and more accurate maps, some of the mouth of the Volga and afterwards the Bakhtemir and other parts of the sea were surveyed between 1823–25 by Lieut.-Captain Bassargin, and some charts containing these new indications were published in 1831, 1837–42. In 1836 the Kara Bugaz gulf was visited by Karelin, who gave some geographical notices about it, published in Vol. 5 of the *Proceedings of the Hydrographical Department;* but the first survey of this gulf was made in 1847, when a war steamship *Volga* circumnavigated the gulf and surveyed it very roughly.

In 1855 the northern part of the Caspian, close to the line drawn from Derbend to Tub-Karagan point, was resurveyed, the shore-lines were made by plane-table work, and all this part of the sea was sounded.

The Pacific Ocean.—The first hydrographical survey in our possession on the shores of the Pacific ocean began under Peter the Great. In 1719 he sent the geodists Evreinof and Loujin to solve the problem

whether Asia touched America or not. They only reached the five Kurile islands, and were forced to return. The report of the expedition was presented to the Tzar in 1722. The question having not been solved, Captain Vitus Bering, in 1725, was sent to Kamchatka as the leader of the first Kamchatka expedition, which continued till 1727, and gave a complete answer on the question at issue.

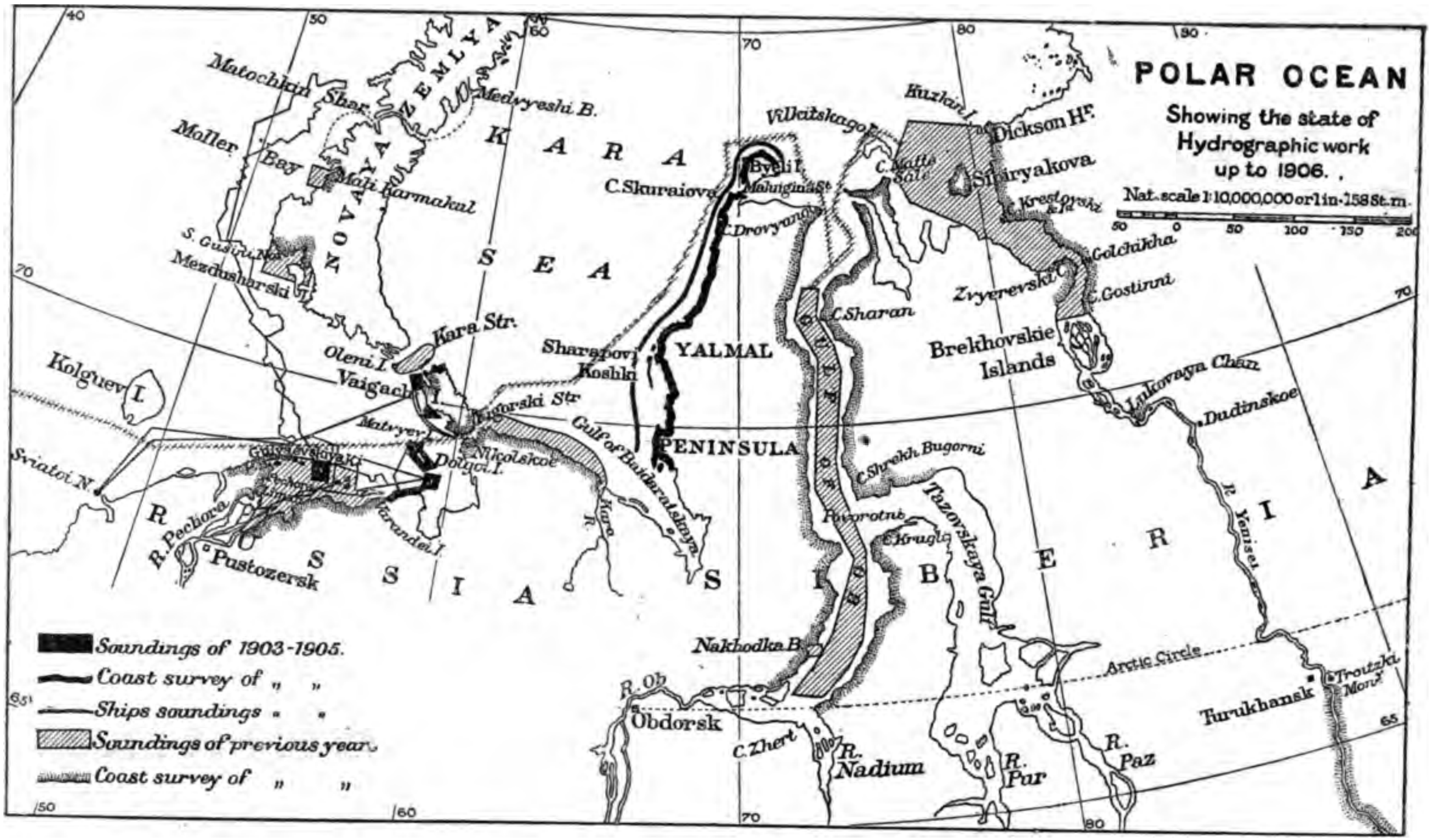
With the intention of surveying the ocean westward of the Kurile islands and reaching the American coast, in 1733, under the command of the same captain, v. Bering, was sent the second expedition (well known under the name of the "Great North Expedition"), part of which surveyed the northern shores of Asia as was ordered, and part of them, under the command of Captain v. Bering, in 1741, after leaving Petropavlovsk, visited the American shores and discovered some of the Aleutian islands. One member of this expedition, Lieut. Khmetevski, in 1743, surveyed the shores of the Okhotsk sea from Okhotsk to Kamchatka and round it. In 1744 a new expedition was sent out with orders to survey the Aleutian groups; the commanders were Captain Krinitzin and Levashev. The ships of the expedition sailed from Okhotsk in 1766 and worked till 1769. The result of this survey was many charts and descriptive reports of different islands of this group.

From 1789 to 1793 Captain Saritchev surveyed the greater part of the shores of the Okhotsk sea, the Aleutian islands, and the shores of America, close to the Isle of Kayak, near the mouth of the Copper river. At the same time (1787–89) Captain Fomin surveyed the south-western corner of the Okhotsk sea, the mouth of the Ouda river; and some time later in 1829–30 the pilot officer, Lieut. Kosmin, surveyed the Ouda river and the Shantar islands. Between 1785–91 Captain Billings made some journeys in the northern part of Siberia, which were described in a work published by him.

In 1851 an expedition was sent under Captain Nevelskoi to survey the mouth of the Amur, which first proved that Sakhalin is an island, and made a complete survey of all the river Amur. Up till 1855 a shore-line of 13,600 versts was surveyed, but it did not give an unbroken line from Bering straits to the Amur.

Marmara Sea.—Besides Russian waters, Russian naval officers surveyed some foreign shores. In 1755–77 the officers of the squadron under the command of Captain Koslianinov constructed some charts of the Sea of Marmara and of the Archipelago; and between 1845 and 1848 a special hydrographical expedition, under Captain-Lieut. Manganari, surveyed and sounded the Sea of Marmara. On these surveys were based the charts of the atlases of that sea published in 1850.

Polar Expeditions and the Circumnavigation Voyages.—Afterwards other expeditions with more extended objects were sent from time to time. One of these was the expedition which, to accomplish the Lomonsovs


POLAR OCEAN
Showing the state of
Hydrographic work
up to 1906.
Nat. scale 1:10,000,000 or 1 in.-158 St.m.
Soundings of 1903-1905.
Coast survey of " "
Ships soundings " "
Soundings of previous year.
Coast survey of " "
KARA SEA
NOVAYA ZEMLYA
Matochkin Shar
Moller Bay
Mali Karmakul
Medvyeshi B.
S. Gusini N.
Mezdusharski
Kara Str.
Oleni I.
Vaigach I.
Yugorski Str
Matvyev
Dolgoi I.
Nicolskoe
Kolguev I.
Sviatoi N.
R. Pechora
Pustozersk
Varandei
Gulf of Baidaratskaya
Kara R.
Sharapov Koshki
YALMAL PENINSULA
C. Skuraiova
Byeli I.
Malugina St.
C. Drovyanoi
Vilkitskago
C. Matte Sale
Kuzkin I.
Dickson Hr.
Sibiryakova
Krestovski
Golchikha
Zvyerevski C.
C. Gostinni
Brekhovskie Islands
Lukovaya Chan
Dudinskoe
C. Sharan
GULF OF OB
C. Shrekh Bugorni
Povorotni
C. Krugli
Tazovskaya Gulf
Nakhodka B.
R. Ob
Obdorsk
C. Zhert
R. Nadium
R. Par
R. Paz
Arctic Circle
R. Yenisei
Turukhansk
Troitzki Mon.
RUSSIA
SIBERIA

project, started twice from Archangel in 1765 and 1766, under the command of Captain Tshitshagov, with the intention of searching for a passage through the Polar sea to Kamchatka. The expedition was unsuccessful in its object; both years it only reached the shores of Spitsbergen, lat. 80° 30′ N., and could not go on through the polar ice.

In 1819 two new expeditions were sent to investigate both the polar basins, south and north. The first, under the command of Captain Bellingshausen, consisted of two ships, *Vostok* and *Mirny* (Captain Lazarev), and was designed to visit the Antarctic ocean. After leaving Kronstadt in July of 1819, both the ships, after a two years' voyage, accomplished a complete circumnavigation of the south polar sea, almost always southward of the polar circle. In their voyage they touched 69° 48′ S. lat., discovered many new islands and the south-western shores of the Antarctic continent. The second expedition was designed to search for a passage from Bering straits to the Atlantic ocean. It consisted also of two ships, *Otkritie*, Captain Vasiliev, and *Blagonamerennui*, Captain Shishmarev. They started from Kronstadt in July, 1819, rounded the Cape of Good Hope, and arrived in Petropavlovsk, from where they started to Bering straits. After a voyage of three years, the expedition returned to Kronstadt in 1822; it surveyed a great length of the shores of America in the Polar sea, and some of the shores of Asia, but the principal object—the search for the passage through the polar basin to the Atlantic ocean—was not attained; very heavy pack-ice, met by the expedition, barred the way.

The first Russian circumnavigation voyage began in 1803 with the expedition under the command of Lieut.-Captain Krusenstern on the *Nadejda*, and Lieut.-Captain Lisyanski on the *Neva*. This voyage occupied three years, during which many geographical discoveries were made. After this expedition many others were sent out till 1848; there were in all thirty-four, fifteen of them sent by the Russian-American Company, one by a private gentleman, and eighteen by the Imperial Navy. Amongst these expeditions there were some of great scientific interest, such as that under Krusenstern and many others, but two of these, sent in 1826 on the sloop *Seniavin*, Captain Lutke, and in 1815 at the cost of Earl Roumyantzef, on the brig *Rurik*, Captain Kotzebue, were especially devoted to scientific purposes. The first surveyed many coasts of islands in the Pacific; Captain Lutke made a great number of pendulum observations still of great value. The second was unsuccessful in his main duty of discovering a passage from Bering strait to the Atlantic ocean, but he made a great number of oceanographical investigations and many surveys of the North American shores.

A third expedition on a warship, the sloop *Predpriyatie* (1823–1826), under Captain Kotzebue, although sent for administrative purposes on the shores of Russian America, made a very interesting oceanographical

investigation with a set of instruments especially invented and constructed for the expedition. The expedition possessed a water-bottle, the sides of which consisted in layers alternately of thin iron and thick cloth impregnant with wax and fat. Because of this construction, the interior temperature of the sea-water was very little altered by the exterior layers of water, the thermometer being in a very thick glass. The necessary corrections to the thermometer's readings were determined by a previous essay.

Anticipating Sir William Thomson (Lord Kelvin) by fifty years, the naturalist of the expedition, E. Lenz, and the member of the Royal Academy, Parrot, invented a sounding-machine with a brake and a dynomometer, with intention to facilitate the determination of the true moment when the sounding-lead touch the bottom. Some of the points in which the observations were made are situated near the points of the *Challenger*, and the comparison of them shows very little difference in temperatures observed (between $0^{\circ}{\cdot}2 - 0^{\circ}{\cdot}3$ C.) for the deep layers (1000 metres and more).

Lakes.—Besides this work, the Russian naval officers made some hydrographical surveys of lakes. The first Russian chart of Lake Ladoga was dated from the early part of the eighteenth century. The next chart was obtained after some work by Lieut.-Captain Selyanikof in 1763–65; this chart was not published, and in 1779, after being completed from the work of Lieut. Boulgakov with his aids, was engraved and published in 1812.

When General Shubert's triangulation and the survey based upon it were achieved, the Hydrographical Department published in 1845 a new chart of Lake Ladoga, on which the soundings were given from the old charts, but the shore-line was new.

Till 1855 no survey was made of Lake Onega.

The Aral sea was first surveyed by the geodesist Mouravief in 1741, and upon his work was based the first chart, which was published at the same time. More than a hundred years passed before investigations were renewed in these parts of Asia. It was not till 1847 that the second expedition, under Lieuts. Boutakof and Mertvago, was sent; their work continued three years, and on the basis of their material three new charts of the sea and its description were published.

Lake Baikal was surveyed first by the pilot officer Poushkaref in 1772–73, and a chart of the lake was constructed by him. The first soundings of the lake were made in 1837 and 1859.

With the year 1855 finishes the first period of the Russian hydrographical surveys, when surveys of many different waters were ordered and made without any consistent definite plan elaborated previously. In 1854 this was regulated, and the Annual Report of the Hydrographical Department published regularly, containing fuller and more accurate data concerning this work. Helped by this set of Reports,

it is possible to prepare a short notice on the hydrographical survey of each of the Russian seas separately from 1855 until the present time.

NEW RECORDS FROM 1855 TO 1905.

White Sea.—The Hydrographical Department, till the year 1856, claimed the necessity of a new and more complete survey of the White sea, but this claim received satisfaction only in 1884. After the first and incomplete survey made by Reinecke in 1827–32 there were no systematic surveys, and all the hydrographical work was done close to the mouth of the Dvina and in some other points on the shore of the sea, but quite isolated and without any connected plan. The most important of these were the survey of the roads off the mouth of the Kem in 1864–65 by the pilot officers Mordovin, Staluigin, and Koslof, and the survey of the mouth of the Mezen and its bay in 1876–78, made by the pilot officer Nyukhalof, and of the roads of Onega by the pilot officer Akhatkin.

In 1884, after many requests from sailors and the Government authorities at Arkhangelsk, the Naval Ministry decided to organize a systematic survey of the White sea; and first it was determined to begin by the survey of Onega bay. In 1884 the pilot officer Myakishef, with six chronometers, obtained the difference of longitude of ten points on the shore of the bay, and in 1885 the survey began by the mouth of the Onega. But the true systematic survey began only in 1887, when an expedition, the first chief of which was Baron Maidel, was sent to make a complete hydrographical survey of the White sea. The west shore of Onega bay was triangulated, and on the basis of this triangulation began the plane-table survey of the bay of Soroka. In the same year the longitude of Archangel was determined by telegraph by Lieut. Wilkitski and the astronomer Wittram in Pulkovo, with the probable error $\pm 0{\cdot}056^{s}$. In 1888–89–90–93 were surveyed the bays of Onega and Soroka, and the roads of Solovetski islands, a part of the bay of Kadalaksha, and the survey of the shores of Onega bay has been continued till the present time. The present state of hydrographical work can be seen on the map of the White sea appended to this notice. There it is clearly seen that up to the present time the whole White sea has only been roughly surveyed and sounded. The open sea has been surveyed by soundings from a ship, and the roads and the approach to them at Archangel, Onega, Suma, Kem, Kovda, Kadalaksha, Mezen, have been surveyed by soundings taken from a launch. These main results, which make it possible to navigate the shores of this basin, are not now considered as the final results of the hydrography of the White sea, and the General Hydrographical Administration (the actual official name of the late Hydrographical Department) are continuing the survey of the White sea. A new and most accurate triangulation has been made of the shores of Onega bay, on the basis

GULF OF BOTHNIA
Showing the state of
Hydrographic work
up to 1906.
Nat. scale 1:4,000,000 or 1 in. = 63·12 Stat. miles
Boat soundings of 1906.
Coast survey of 1906
Ship soundings of 1906.
Coast survey from 1853 to 1906.
Boat soundings from 1853 to 1905.
Ship " " 1853 to 1906.
Tornea
Kemi
Simo
Uleaborg
Brahestad
Skelleftea
Robertsfors
Umea
Nordmaling
Örnsköldsvik
Kwarken
Storkallagrund
Hernösand
Sundsvall
Hudiksvall
Söderhamn
Gefle
Gamla Karlebyu
Jacobstadt
Nya Karlebyu
Oravais
Nikolaistad
Wasa
Petalax
Rangsbyu
FINLAND
Christinestad
Sidbyu
Knäppelgrund
Sastmola
Hvittisbofjard
Björneborg
Raumo
Pikeluoto
Nystad
(See Plan No. 1)
Nodendal
ABO (See Plan No. 2)
Borgo
Helsingfors
Kimito
Market
ALAND Is.
Mariehamn
GULF OF FINLAND
Hango Hd.
SWEDEN
GULF OF BOTHNIA

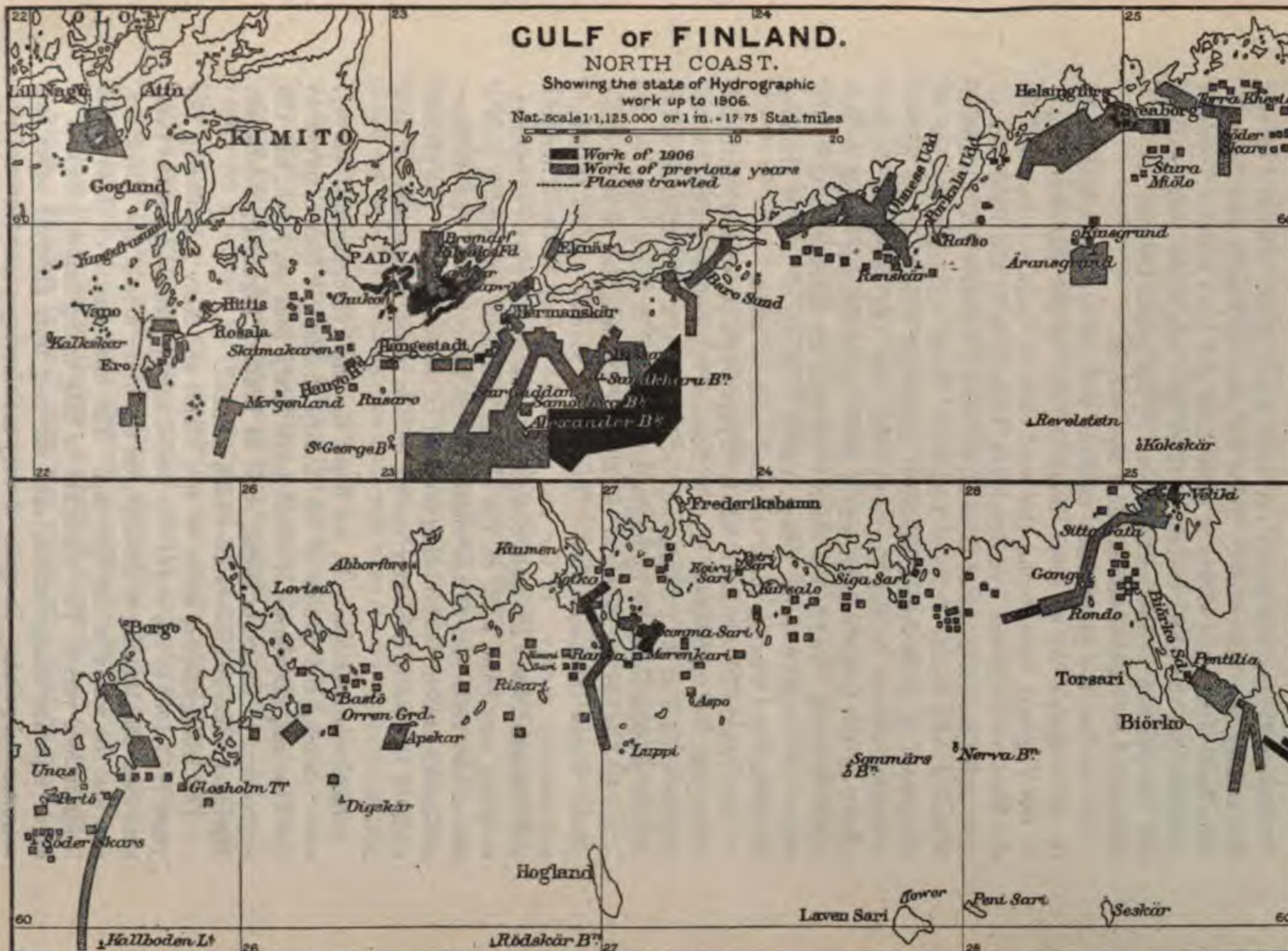
of which a new survey is being made. The principal object of this work is to cover the shores of the whole sea by a network of triangulation, which can alone make it possible to prepare accurate charts. At the same time the most dangerous parts of the White sea were resurveyed in last years; for example, the Orlov banks at the entrance from the Polar ocean to the sea.

Polar Ocean.—In the Polar ocean the most frequented coast is the so-called Murman coast lying between Norway and the entrance to the White sea. This part of the shores of Russia has never been surveyed regularly. The only work done there is the survey of different isolated places, and a preliminary survey of the main part of this coast is due to the well-known Russian naval officer, Captain Lutke (afterwards Count Lutke), who, in his cruise in the Polar ocean, in 1821–24, surveyed the main part of the Murman shores and the greater part of the shores of the island Novaya Zemlya. His work was continued by Lieut.-Captain Reinecke, and the survey of the Murman coast up to Norway was finished in 1832. From this time till the present many other surveys have been made on this shore, but they belong to the survey of different isolated places, such as certain roads, entrance to roads, etc., especially in the last years by the hydrographical expedition of the Polar ocean under Colonel Wilkitski. In the summer of 1904 the difference of longitude between the port of Alexandrovsk and Pulkovo was obtained by means of the telegraph, and a regular survey of these shores began in 1905 under Lieut.-Captain Bukhteef.

The greater hydrographical work of the last years in the Polar ocean was made by a special so-called hydrographic expedition of the Polar ocean. The first investigation began in 1894, under Lieut.-Colonel A. Wilkitski, and during the first time the work of it was consecrated to the hydrography of the sea route to Siberia. The mouth of the Yenissei, the gulf of the Yenissei and the river itself were surveyed up to Yenisseisk; after this the shores of the Polar ocean were surveyed close to Dickson bay on the east, and the entrance of the Obi gulf on the west. Later, the Obi gulf, the mouth and the river close to the Samarovo and its tributary the Irtish to Tobolsk were surveyed. The northern part of the isle Belui, some parts of the shores of Kara sea, and the delta of the Pechora were also surveyed, as some points on the Murman shores. In 1902 the expedition under Lieut.-Captain Warneck, and finally (1903–1904) under the command of Colonel Drijenko, continued its work in the Kara sea, on the shores of the Novaya Zemlya, on the Murman shores in the Pechora estuary, where the timber trade, especially with England, has lately been much developed.

Great were the geographical results of this expedition; they were given by me in a special notice, published in the *Journal* some time ago, and it is unnecessary to repeat the detail of that work.*

* *Geographical Journal*, 1898, vol. 12, pp. 172–176.


GULF OF FINLAND.
NORTH COAST.
Showing the state of Hydrographic work up to 1906.
Nat. scale 1:1,125,000 or 1 in. = 17·75 Stat. miles
Work of 1906
Work of previous years
Places trawled
KIMITO
Gogland
Helsingfors
Sveaborg
Hango
Rosala
Ero
Renskär
Baro Sund
Åransgrund
Revelstein
Kokskär
St George Bn
Frederikshamn
Lovisa
Borgo
Kotka
Hogland
Laven Sari
Torsari
Biörko
Biörko Sd.
Kallboden Lt
Rödskär Bn
Digskär
Glosholm Tr
Nerva Bn
Seskär
Peni Sari
Luppi
Aspo
Äpskär
Orren Grd.
Bastö
Risari
Siga Sari
Unas
Söder Skars
Abborfors
Kaumen
Gangas
Rondo
Pentilia
Sommärs Bn
Stura Miölo
Rafso
Porkala Udd
Obness Udd
Ekenäs
Hermanskär
Morgonland
Rusaro
Kalkskär
Vano
Lill Nagu
Attu

Novaya Zemlya was partly surveyed many times. The first survey has already been mentioned. Since the year 1882 many small expeditions have visited the shores of these isles and have surveyed various localities, but the whole outline of these isles has never been charted, and the position of the northern end of the group has not yet been ascertained by reliable astronomical observations.

In the last few years many new and good surveys have been made in the Belushya bay by Lieut. Bukhteef, and in the Matochkin Shar, in the Yugorski Shar, round the west coast of Vaigats island, and in the Kara strait by the hydrographical expedition of the Polar sea, at first under the command of Colonel Wilkitski, secondly Lieut.-Captain Warneck, and finally Colonel Drijenko. From the point of view of navigation in these waters, the most important work was the hydrographical survey of the Yugorski Shar and the shores of Vaigats island, on the south-west of which good anchorage was found in the bay of Warneck; and in the north-west, near the entrance to the Kara strait, the Dolgaya Guba, where, beside a group of islands (Belkin, Shokalsky, and others), there are good roads for ships.

Baltic Sea.—In this basin regular hydrographical work is continued every year, but its progress is slow, because the hydrographical survey of such a place as the "Shärgoord" of Finland is a very difficult work. At the present time the hydrographical survey is being made in the Åland islands, on the shores of the Gulf of Bothnia, and in some other places, where the necessities of navigation require a more thorough and accurate survey. In the last years the survey of the Kronstadt and Transund roads has been completed by accurate winter soundings, entailing very hard work on the officers and men, but which give a full and accurate idea of the contour of the sea-bottom. The entrance to Khotka harbour is also being sounded in the same way. The present state of the work is clearly shown on the chart accompanying this notice.

Black and Azov Seas.—In the Black sea the hydrographical survey, after reaching the middle of the eastern shores, has been removed to the Azov sea, the shores of which have lately been surveyed, and the approaches to the main ports, such as Rostov, Taganrog, Berdiansk, Mariupol, Eisk, and others have been sounded.

The triangulations made in the Black and Azov seas during the years 1873–1903 to the end of this period surrounded the shores of these seas from the Danube to Sukhum on the other side of the Black sea, and also the whole of the Azov sea. The total length of these coasts is about 2600 versts. The whole net of this triangulation consisted of seven separate triangulations, each starting from different bases and astronomical points. In spite of very satisfactory accurateness of each separate triangulation as a first-class one, in all districts where the separate triangulations joined one another the discrepancy, partly on

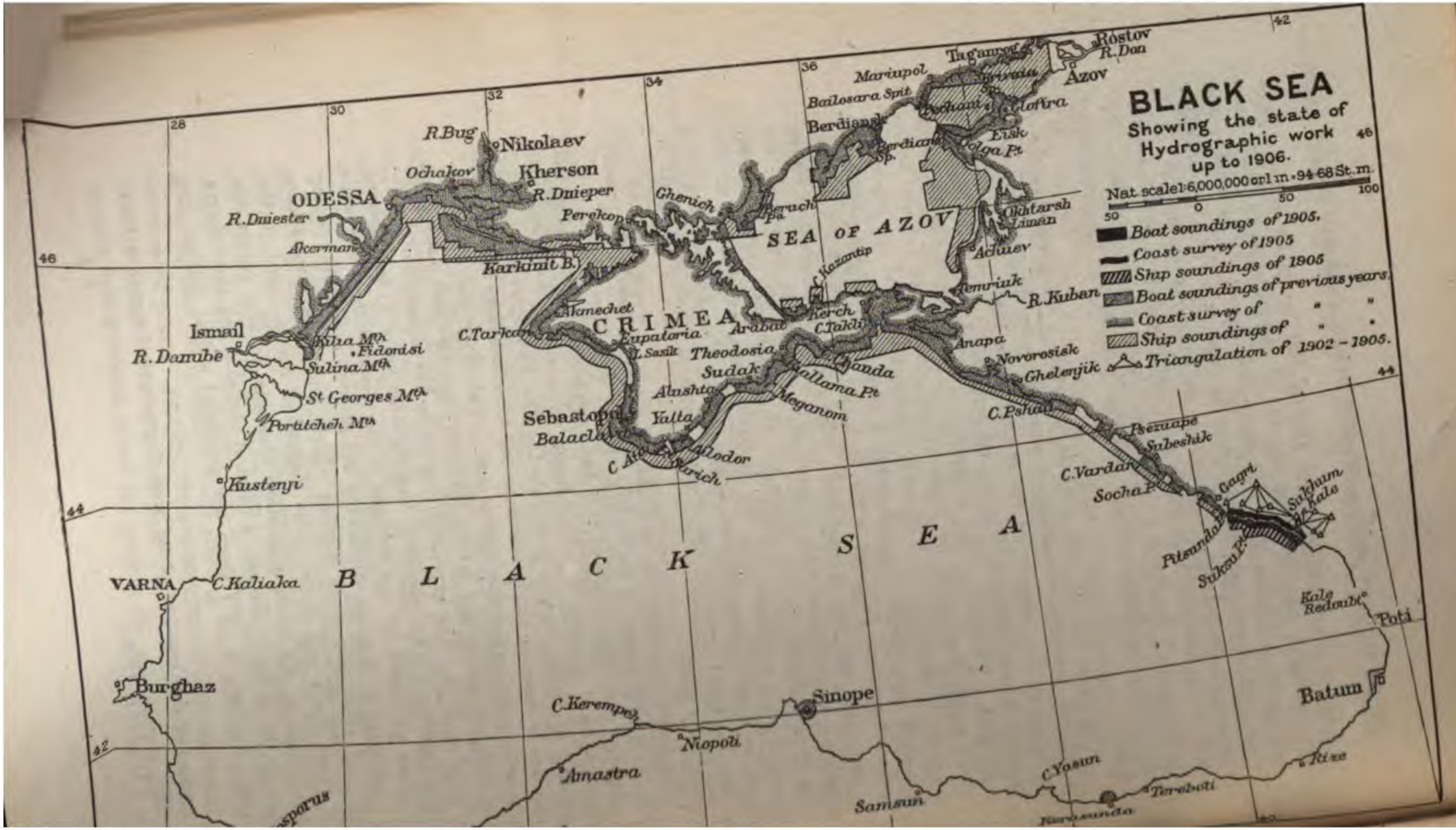
account of the deviation of the vertical line, especially in the Crimea and Caucasus, and partly on account of accumulation of errors, was very great, attaining here and there 200 sagens. The chief of the Main Hydrographical Administration, in order to obviate this difficulty, charged Captain-Lieut. Bukhteef to make the compensation of all these triangulations of the Black and Azov seas, taking as a base-point the position of the Naval Astronomical Observatory at Nikolaev. The method of compensation chosen was that used in the triangulation of India.*

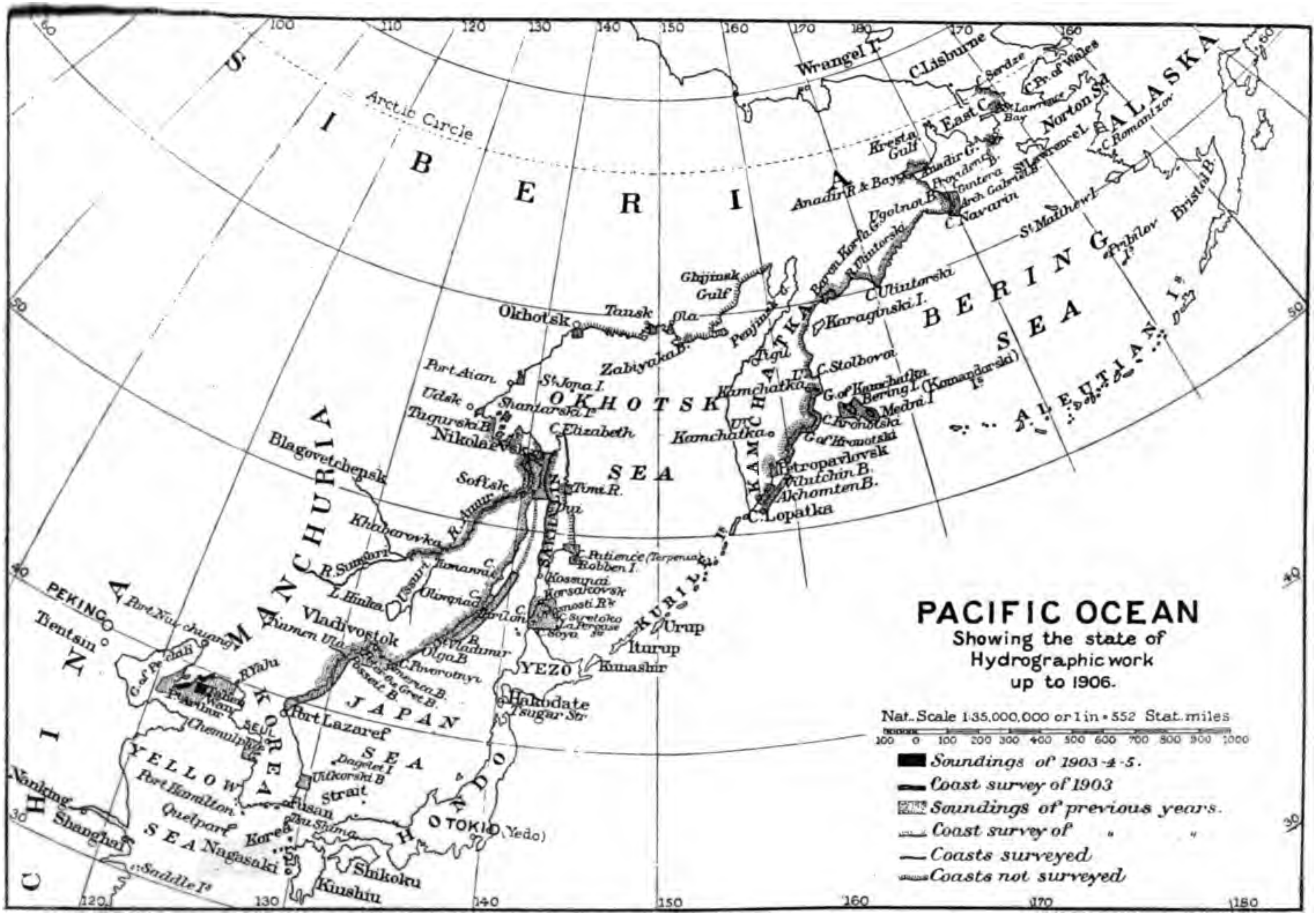
The main idea of this work is to obtain a consecutive system of points, the comparative positions of which are sufficiently accurate (corresponding to the accuracy of the triangulation itself) to be taken as a basis for future hydrographical and cartographical work in the Black and Azov seas. The work of the compensation was based on the dimension of the earth determined by Bessel instead of those of Valbeck, which are used to calculate each separate triangulation. At the beginning it seemed that this duty would occupy a period of five years, but, thanks to the exceptional diligence of Mr. Bukhteef, all the work was finished in two years, and now is completed. The sufficient accuracy of all the separate triangulations made it possible to compensate very well: the final result shows that the whole net of triangulation could be compensated with agreement of $0''{\cdot}001$ in latitude and longitude of all the points, without altering original angles of the triangles more than $5''$; as the probable error of the original angle is $+2''{\cdot}3$, this result is wonderfully good.

The chart accompanying this notice shows most clearly the present state of our knowledge of the hydrography of these seas.

Caspian Sea.—The charts of this basin are based on the work of the hydrographical expedition, which began its work in 1856 under the command of Lieut.-Captain Ivashintsef. The hydrographical survey of this sea is based on thirty-two main and some secondary astronomical points which the expedition determined. This duty and the survey of the different shores, and taking the soundings, occupied many years from 1856 to 1874. The expedition was under the command of Lieut.-Captain Pushtchin, when results of that eighteen years' hydrographical work were published in two volumes of the description of the work done; an atlas of that sea, containing one general chart, three sailing charts, and thirty-two more detailed charts and plans; two atlases of the river Terek and Kura; three magnetical charts, based on the determinations of the three magnetical elements, in fifty points distributed on the shores of the sea; a chart of currents, and three charts of winds. Further, in 1877 there was published a final volume, due

* 'Account of the Operations of the Great Trigonometrical Survey of India vol. 2. 1899.


BLACK SEA
Showing the state of Hydrographic work up to 1906.
Nat. scale 1:6,000,000 or 1 in. = 94·68 St. m.
Boat soundings of 1905.
Coast survey of 1905
Ship soundings of 1905
Boat soundings of previous years
Coast survey of " "
Ship soundings of " "
Triangulation of 1902 – 1905.
SEA OF AZOV
CRIMEA
B L A C K S E A
ODESSA
Nikolaev
Kherson
R. Dnieper
R. Bug
Ochakov
R. Dniester
Akerman
Ismail
R. Danube
Sulina Mth
Fidonisi
St Georges Mth
Portitcheh Mth
Kustenji
VARNA
C. Kaliaka
Burghaz
Perekop
Karkinit B.
C. Tarkan
Akmechet
Eupatoria
Sebastopol
Balaclava
Yalta
Alushta
Sudak
Theodosia
Meganom
Kerch
C. Takli
Arabat
Ghenich
Kazantip
Berdiansk
Mariupol
Bailosara Spit
Taganrog
Rostov
R. Don
Azov
Eisk
Temriuk
R. Kuban
Anapa
Novorosisk
Ghelenjik
C. Pshad
Psezuape
Subeshik
C. Vardan
Socha Pt
Gagri
Sukhum Kale
Kale Redoubt
Poti
Batum
Rize
Terebuli
C. Yasun
Samsun
Sinope
Nopoli
C. Kerempe
Amastra


PACIFIC OCEAN
Showing the state of
Hydrographic work
up to 1906.
Nat. Scale 1:35,000,000 or 1 in = 552 Stat. miles
Soundings of 1903-4-5.
Coast survey of 1903
Soundings of previous years.
Coast survey of " "
Coasts surveyed
Coasts not surveyed
SIBERIA
ALASKA
BERING SEA
OKHOTSK SEA
KAMCHATKA
MANCHURIA
KOREA
JAPAN SEA
YELLOW SEA
CHINA
ALEUTIAN Is
KURILE Is
Arctic Circle

to Lieut.-Captain Pushtchin, containing the hydrographical description of the sea and pilot directions for it. From this time no systematic hydrographical work has been done, excepting only in the parts of the sea where the business of navigation demanded a new investigation.

Pacific Ocean.—Till 1862 the only hydrographical survey on the shores of the Pacific ocean consisted in a few preliminary surveys of some bays and roads in the sea of Okhotsk and other places belonging to Russia. This survey had been made without any systematic plan by the naval officers of different men-of-war navigating these waters. The first true hydrographical survey began in 1862, when an expedition was organized under the command of Lieut.-Colonel Babkin, who in four years surveyed the shores from the Korean frontier up to Gamof point, and from Vladivostok to Suifun; also the mouth of the Amur and Sakhalin channel were sounded in the winters of 1864–66.

In order to obtain a better basis for the hydrographical survey, Lieut. Staritzki was sent there in 1866. In five years he determined the geographical position of thirty-eight points on the shores of the Japan, Okhotsk, and Bering seas; he observed, also, the magnetic declination in twenty points, inclination in sixteen points, and the horizontal force in four points. He had made the plane-table survey of five roads on the shores of Sakhalin, and a naval survey of a portion of the western shores of this island. Lieut. Yelagin continued the work of Lieut. Staritzki.

At the end of 1871 Lieut. Onatzevitch was placed at the head of the hydrographical survey of the Pacific Ocean, and at the same time another expedition, sent by land, under the command of Lieut.-Colonel Bolshef, surveyed the shores of the Japanese sea and of the Tartar strait for a distance of 800 versts, and for 3 versts into the interior of the country.

Lieut. Onatzevitch, besides different hydrographical surveys on the shores of the Japanese, Okhotsk, and Bering seas, did some oceanographical work in the Arctic ocean.

From the year 1877 till 1885 surveys were made in different places of the Russian shores of the Pacific ocean, principally in the delta of the Amur river and around Vladivostok. From 1855 till the end of the century surveys were made generally in the bays of Amur and Ussuri, and along the shores of the Japanese sea between Vladivostok and Korea and westward of Vladivostok. All this work was based on good triangulation, which extended all along these shores.

At the same time many other hydrographical surveys were made with the intention of improving the present charts, which are very incomplete and not sufficiently accurate, especially as regards the shores of the Okhotsk and Behring seas, and Arctic ocean. This work was done by the officers of the different men-of-war, which had navigated in these waters for different purposes. Amongst these vessels it is

interesting to remember the work of the *Vitiaz*, on board of which S. Makaroff made a great quantity of different oceanographical investigations in many places of all the seas touching these shores, published afterwards by him in the work entitled '*Vitiaz* and Pacific Ocean.'

In later years there was a special hydrographical expedition, under the command of pilot officer Colonel Jdanko, well known for his hydrographic investigations in the Baltic and White seas and in the adjacent parts of the Polar ocean. He did a great deal of work, especially on the shores of the Yellow sea and in the Tartar strait.

The chart accompanying this notice shows clearly the present state of the hydrography of the Russian shores in the Pacific ocean.

SOME NOTES ON DAR HOMR.

By Captain WATKISS LLOYD, the Scottish Rifles.

THE following notes are the result of four journeys made between June, 1904, and February, 1906. A glance at the map will show that much remains to be explored, although the general character of the country is now well known.

Dar Homr, or the country of the Homr Arabs, is situated in the south-west corner of the province of Kordofan. The western boundary is the Darfur frontier, beyond which live the Rizeigat Arabs. On the north, the boundary passes through El Odaiya, now the headquarters of a Merkaz, or administrative district, and thence south-eastwards, passing south of Burdia and Jebel Dago to Keilak. El Odaiya is in the Hamr country, the inhabitants being a sedentary tribe of Arabs. Burdia and Jebel Dago are in the Messeria, and Keilak in the Hawazma country. Both these tribes, like the Homr, are Baggara Arabs—that is to say, cattle-owning nomads. The southern boundary is between the Bahr el Arab and the river Kir, the latter being occupied by the Dinkas under Sultan Rob.

The whole forms a vast and almost level plain, covered with thick bush and a few scattered tebeldi trees (*Adansonia digitata*). Except in the Mumu district near El Odaiya, they are never sufficiently numerous to provide water storage for a village. At Mumu they are hollowed out and filled every year as in Dar Hamar.* In the north the soil is reddish sand, interspersed with tracts of sand and clay mixed, forming a soil called "gerdud." This gradually increases further south until the red sand disappears, and black soil commences. South of lat. 10° 30′ black soil predominates. When dry it becomes full of shrinkage-cracks, and is locally called "shegantoi." In a few places where the

* *Vide* the Compendium of the Anglo-Egyptian Sudan. Map, p. 700.

underlying rock can be seen, as at Um Hagar and south of Jebel Abu Likri, it is red sandstone, containing much iron, and similar to that found near Wau in the Bahr el Ghazal province.

The arable land consists of ridges of grey sandy soil found chiefly in the vicinity of Muglad and Baraka. These ridges, which are seldom more than 10 or 12 feet high, are divided by level strips of "gerdud" soil called "dandaana," in which there are small swampy pools called "kubbu." In the rains the Homr Arabs take up their quarters near these ridges, and cultivate dukhn, their only crop, watering their flocks and herds from the pools, which hold water from six to eight weeks after the last storms, according to the year.

Between Mumu and Muglad there is a tract of sandy soil which is uninhabited owing to the absence of either tebeldi trees or "kubbus." In the south, where the black soil predominates, the country is broken by "ragabas." These consist of depressions full of grass and creeping plants. During the rains they are under water, and the rest of the year water can always be obtained by digging down a few feet. In many the surface water never dries up. There are no signs that the water in them ever flows, the mud and vegetation forming a water-logged mass. Where "gerdud" soil exists, it is broken up by strips of black soil known locally as "shellal." These form a serious obstacle to travelling for some time after the "gerdud" soil is dry.

The country is traversed by two main watercourses, the Wadi el Ghalla and the Khor Shalango. The Wadi el Ghalla rises near Abu Gulb in Dar Homr, and, flowing through El Sinut and Burdia in Dar Messeria, continues its course to Um Guru, and thence south of Muglad district to Dar Rizeigat, where it is said to lose itself. It breaks into many channels, which separate and join again, and is fed by numerous small khors. During the rains it holds much water, but there is little or no flow throughout, as its channel is blocked with trees and grass. In the dry season wells are dug at many points in its bed. As it is smaller at Muglad than at many points higher up, it would seem to be silting up and turning into a "ragaba" at its southern end, just as at its northern end near Abu Gulb it is filling up with sand blown from the north.

The Khor Shalango rises north-east of Jebel Dago, flows westward at first, and then southwards, passing north and west of Jebel Dago in a channel 30 yards wide and 25 feet deep. When east of Turda it breaks into several small channels, and finally loses itself near Fauel in the swamps which are connected with the Bahr el Arab. When in flood it overflows its banks, and inundates a vast extent of country on both sides to a depth of 18 inches, to judge from the marks on the trees. The vicinity of the hills, and hence its greater fall, has kept the channel clear until near the latitude of Turda.

In the rains the whole of the country south of a line from Muglad to

Jebel Dago is more or less under water. North of this line there are plenty of pools holding water for two or three weeks after the last storms. About six weeks after the last storms the pools in Muglad dry up, followed by the pools and khors further south, until by about the middle of December the only surface water is found in the wells and "ragabas," and the Muglad district has to be deserted. As soon as the grass is dry enough to burn, the people move south, burning it before them to the ragabas, where there is surface water, and finally, as the ragabas dry up, to the Bahr el Arab, where they remain until the rains break. Then, as soon as the pools fill, and before the country has agaih become a swamp, they return northwards to their rain quarters.

In addition to the wells in the Wadi el Ghalla and Khor Shalango, there are a few places near Baraka where there are permanent wells.

The chief roads are well-worn cattle-tracks. North of Muglad there is enough sand in the soil to render them passable all the year round. In the south, however, they are generally impassable, owing to mud and grass, until a month or two after the rains, which commence in the middle of May and sometimes last to the end of October, but are heaviest in June and July. Once open, they are fairly good, except where cut up by elephant-tracks.

The Homr are divided into two chief divisions—the Ageira under a nazir, Sheikh Ali Gulla, and the Felaita, who have no nazir. They say they came from Northern Africa *viâ* Wadai, and have probably not occupied their present country for more than a hundred years. They say they preceded the Hamar, who entered Kordofan during the first quarter of the last century. They speak a purer Arabic than the riverain Arabs. The Ageira are divided into the Walad Kamil and the Walad Omran. During the rains the Walad Kamil cultivate the western and southern parts of Muglad district, and afterwards are found on the ragabas west of the Turda-Fauel road. The Walad Omran have their cultivation in the eastern part of Muglad district and at Baraka, and afterwards go to the ragabas east of Turda and Fauel. The Falaita, who are only half as numerous as the Ageira, are divided into the Metanin, who live at Mumu, now practically a sedentary tribe, depending on El Odaiya wells for their water in the dry season, the Walad Serur at Keilak, and the Salamat and Gubarat at the Abiad lake; but many of the last three sections cultivate on the Wadi el Ghalla, north-east of Baraka, and more east of the Walad Omran camps in the dry season. Each tribe has its own place for cultivation, its own ragabas, and its own line of migration, all which change but little from year to year.

The tribe was formerly very numerous and wealthy, but suffered severely in Dervish times. The greater portion were fanatical followers of the Mahdi and his successor, and lost heavily in the various campaigns

between 1884 and 1899. The few who remained behind were constantly raided and harassed by recruiting parties of Dervishes.

They are a wild and rather insubordinate lot, and pay but little respect to their own sheikhs. They are, however, settling down, though many look back with regret to the merry times when, as relations of the Taisha and favourites of the Khalifa, they could rob and raid as they liked, while those sheikhs who were emirs no doubt feel their fallen greatness. On the other hand, they are in many ways one of the best tribes in Kordofan. Petty crime is practically unknown, while murder is uncommon and generally due to quarrels about women. Murders are still settled by payment of blood-money, thirty cows being the usual price for a man. The fine is paid to the nearest relation of the murdered man. The case is usually settled by the local sheikhs, who afterwards inform the British inspector. Being dependent on public opinion for their influence, the decision of the sheikhs is usually a just one, and the fear that the Government may hang an offender prevents them from screening even their own relations. Cases of drunkenness are rare. From time to time they have quarrels with the Dinkas. These are usually due to elephant poaching by the Arabs, who have the most democratic ideas about game. Nothing will persuade an Arab that he has no right to hunt in another tribe's country.

Practically the only crop grown is dukhn (millet). As soon as this is ripe, usually by the first week in November, it is threshed, and enough for seed and food during the next rains is stored in trees, the remainder being loaded on bulls and taken to the summer camps. Should the supply be insufficient, grain is exchanged for sheep or cows with the Nubas or Dinkas.

With the exception of a few leather goods, such as *khurgs*, or skins for water or grain, nets to carry water-pots in, and bridles, the Homr manufacture nothing. They buy their pots from Jebel Dago or El Odaiya, and cotton from travelling merchants or from El Odaiya.

Constantly on the move in search of water or fresh grass, their camps are of the most primitive description. In the rains some live in small and badly built straw huts (*tukls*) of the pattern usual in the Sudan, but the majority content themselves, both in the dry and wet seasons, with a few sticks covered with a quantity of grass, the whole not more than 10 feet high. The shelters of neatly plaited matting made by the Hawazma and Messeria are never seen owing to the absence of dom and deleib palms, from the leaves of which they are made. The camps as a rule consist of only three or four families, and are widely separated. This is due to the scattered nature of the ridges on which they cultivate in the rains, and the abundance of water for the cattle at all seasons. As a result the tribal organization is much looser, and the influence of the sheikhs much less, than in most nomad tribes.

Their wealth consists of cattle, sheep, and horses, all of which have much increased of late years. The bulls are small but strong, active animals, and will wade through mud that would stop any horse or mule. The saddle consists of two pads of plaited grass called *tibn*, which grows in the swamps. The lower pad is plain; the upper one has one, or sometimes two, trees made of a forked stick tied to it. The load averages 200 lbs., with a man or woman to balance it, no girth being used. A string is passed through the nose, but is seldom used unless it is necessary to tie the animal up.

The sheep are of two kinds: the large Roman-nosed sheep of the Sudan, and the smaller and more active animal of the Nuba hills.

Their horses are small, and are a very mixed lot, having been bought during the last few years from merchants and from the Messeria. They nearly all show signs of having been worked too young. Every year a good many die from horse-sickness.

Camels are not used, and the animal of the Camel Corps, in out-of-the-way places, is generally a source of terror to the small children, who, as elsewhere in the province, swarm in every camp. They are naked, healthy youngsters, who live chiefly on milk.

Their household utensils are simple, and do not differ much from the other tribes in the Sudan. Most own a very short and narrow bedstead (*angareb*). The rest, when in camp, drive forked sticks 18 inches long into the ground and lay poles across on which to spread their mat or sheepskin; this is called a *hasira*. Many own grindstones (*murhaka*); the rest crush the grain with a wooden pestle (*amud*) and mortar (*fanduk*). A few earthenware pots (*kantush*) carried in leather nets (*maluk*), some wicker baskets (*omra*), water-tight with dirt for milk, and some skins for grain and water, complete their outfit.

Every man carries arms. Usually a *kiblis*, or large stabbing-spear, and often several smaller spears. Swords are uncommon, and rifles are seldom seen.

The majority still wear native grown and woven cotton called *damur*, but there is a constant demand for blue and white European cottons, especially for women's wear, as the men find the material supplied by the merchants does not wear so well as damur. The men's shirts, or *jabbas*, are made with very wide sleeves, which have to be tied up behind the neck when doing any work. The damur is all purchased at El Odaiya or Jebel Dago, none being made locally. The women own but few ornaments. Even the silver nose-ring, which every Howazama and Messeria woman wears, is by no means common. But a taste for expensive luxuries is growing, and there is no doubt that before long the necessity of gratifying female vanity will force the men to work and to trade as in less happy lands.

Living in a damp climate most of the year, and near pools and swamps full of mosquitoes, fever is very common, and as a result enlarged spleens

are often seen. A very large percentage suffer or have suffered from guinea-worm (*ferintit*), and there are a considerable number of cripples from this cause. Enlarged joints, probably due to rheumatism, are common; but elephantiasis, so common in the Nuba hills, seems to be unknown. Small-pox is described as epidemic and visiting the country at rare intervals.

As might be expected from the above account, there is but little trade in the country at present. But, in spite of the Baggara's love of doing nothing, it is increasing. Cattle and sheep are sold for horses, cottons, salt, and pepper. A certain amount of ivory is obtained by hunting, and a little is bought from the Dinkas in exchange for cows. The money in most general use is the Mejidi dollar, worth about half a crown, and the Kabashi piastre, twenty of which go to the Mejidi dollar.

A great deal of trade passes through the country, however. A road from Shakka to Nahud enters Kordofan at Muglad, and the main route from Dar Jange to Nahud is *viâ* Turda and Muglad. Merchants buy cows for the Dar Jange trade in Nahud during the rains, and take them to Muglad. When the roads are open they go south to Dar Jange, where they purchase bulls and ivory for the Khartum market, returning at the commencement of the next rains. Trade through Shakka is chiefly with Dar Fertit, and consists of cottons and beads to exchange for ivory.

There is a good deal of game in the country. In the rains elephant and giraffe must be numerous, to judge by their tracks, but in the dry season they all go to Dar Jange. Roan antelope and water-buck are fairly common. Liang are numerous, and Jackson hartebeest swarm in every ragaba. Bush-buck, reed-buck, and gazelle are plentiful, and kudu are said to be found in small numbers. Lions are common at times, but leopards are scarce.

THE RAINFALL OF THE BRITISH EAST AFRICA PROTECTORATE.

By GEORGE BRANSBY WILLIAMS.

UNTIL within the last two or three years no effort appears to have been made to record the annual rainfall in the East Africa Protectorate in a systematic manner, but during the years 1903 and 1904 a number of new gauges were fixed, and the results are now tabulated, and, together with other meteorological information, are published annually by the Agricultural Department.

There are at the present time between thirty and forty recording stations in the Protectorate, but they are confined to the coast and a belt of country some 60 or 70 miles wide along the Uganda railway. Few of these rain-gauges have been established for any length of time, and none of the longer records are perfect from the commencement.

The oldest recording stations are Mombasa and Malindi, where the gauges appear to have been fixed in 1890. The record at Mombasa is continuous from 1891 to 1897, and from 1899 to 1905. At Malindi the figures for the years 1896 and 1897 are missing. At Kismayu and Machakos there are continuous series of gaugings during the ten years 1896 to 1905; at the latter station the rainfall was first recorded in 1894, but during the latter half of 1895 no observations were made. Amongst the other up-country stations, the records at Kikuyu and Mumia's commence from 1896, but there are gaps in both. In the whole Protectorate there are only eight stations at which observations have been made continuously for six years.

It is impossible to compile a complete and accurate rainfall map of the whole country from such imperfect data, but a careful study of the returns from all the stations enables one to sketch in the apparent position of some of the isohyetals (or lines of equal rainfall) in that part which has so far been opened up to European settlers.

Accurate statistics of the rainfall in the Protectorate are of such great importance that it is very desirable that many more rain-gauges should be fixed covering a wider area of country than at present. One of the objects of this short paper is to indicate where they could be placed to the greatest advantage.

The variations in the annual rainfall have been very considerable even during the last six years. Diagram 1 shows graphically the comparative fluctuations during the years 1900–1905 at five stations in the Protectorate, viz. Kismayu, Mombasa, Machakos, Nairobi, and Mumia's. For the purpose of comparison between the different stations, the ordinates in the diagram are plotted so as to show the rainfall for each year reduced to a percentage of the average annual rainfall for the six years at the station. The greatest variations from the average were at Kismayu, where the rainfall in 1902 was 145 per cent., and in 1903 only 47 per cent. of the average. At Machakos in 1900 the rainfall was 142 per cent., and in 1904 69 per cent., of the average.

As might have been expected, there is little resemblance between the curves at stations remote from each other, but there is a nearer relationship in the case of stations closer together, and where the climatic conditions are approximately the same. Thus, in 1903, which was a wet year at Mumia's, but a very dry year at Kismayu, it is interesting to note that, placed in order of wetness, the stations read thus: Mumia's, Nairobi, Machakos, Mombasa, Kismayu, which is the natural order. In 1902, by transposing Mumia's and Nairobi, they read the opposite way; the same applies to 1901 if Nairobi and Machakos are transposed.

Diagram 2 represents the seasonal fluctuations, and compares the average amount of rain falling in each month throughout the year at three stations—Mombasa, Nairobi, and Mumia's—representing respectively the coast, the central district, and the country round the Victoria

Nyanza. The average is taken of the same six years (1900–1905), and the result shows a marked difference in the intensity and duration of the wet and the dry seasons at the three places. At Mombasa the autumnal rains are the most marked feature; the wettest month is May, when the rainfall is three and a quarter times the monthly average. The lesser rains at the end of the year are of comparatively little importance,

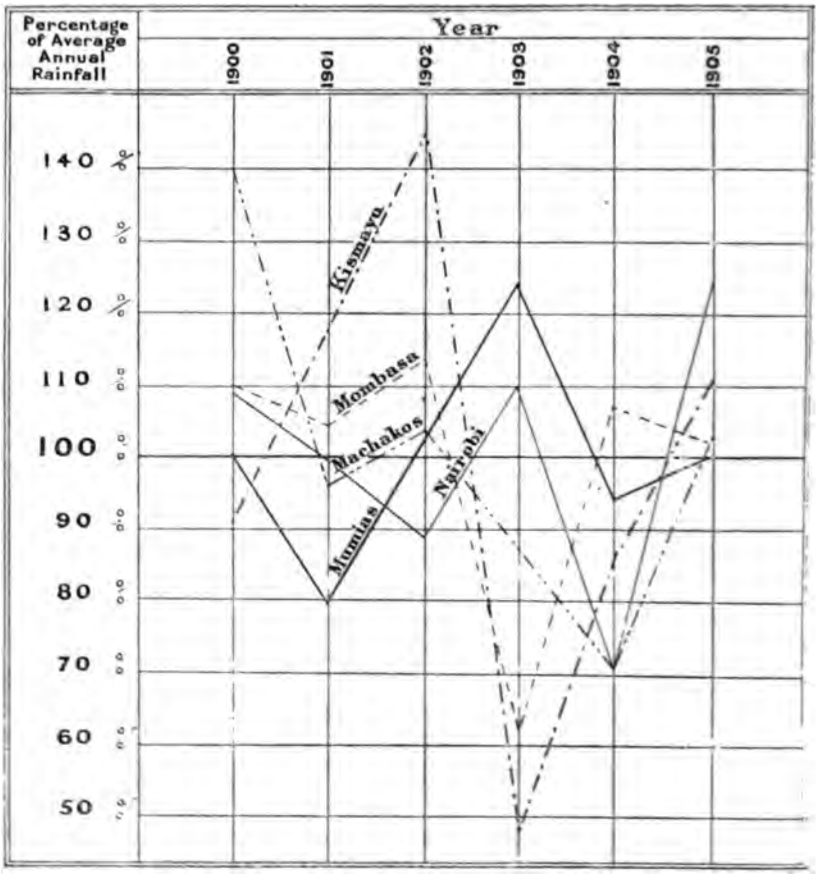


FIG. 1.—COMPARISON OF FLUCTUATIONS IN THE ANNUAL RAINFALL AT FIVE STATIONS IN EAST AFRICA DURING THE SIX YEARS 1900–1905.

November being the only month with a rainfall above the average. January and February are the driest months.

At Nairobi, on the other hand, the lesser rainy season assumes a relatively greater importance. April is the wettest month, but November and December are both wet months, December especially so, having a rainfall of 168 per cent. of the monthly average. The long dry period between June and October is much more marked than at Mombasa; but February, which is a dry month at Mombasa, is a wet month at Nairobi.

At Mumia's the rainfall is much more evenly distributed throughout the year. April and May are wet, and December, January, and February dry, but the other months do not vary much in wetness.

The rainfall, both at Machakos and at the coast stations, appears to have averaged about 10 per cent. more during the six years (1900–1905) than during the ten years (1896–1905). It is very possible that the average for these ten years in the central district is somewhat below the true mean annual rainfall, for the year 1899 was one of exceptional drought, but there does not appear to be any serious difference at the coast between the average for the ten years and for the fifteen years (1891–1905), which is as far back as we can go. For the present purposes, the average rainfall for the ten years 1896–1905 has, therefore, been assumed to be the true mean annual rainfall, wherever so long a record exists, and the shorter records have, when possible, been standardized by comparing them with this mean at other stations in the same district. Shimoni and Mombasa have been used to correct the stations at and near the coast, Machakos and Kikuyu for the central district as far as the Rift valley. In the country near the lake, the Mumia's record is the only one available for this purpose. In this the year 1899 is missing, so the average for the remaining nine years has been taken. There are some discrepancies in the rain-gauges near the lake, so the figures shown can only be considered approximate and provisional until further and more accurate information has been obtained.

The method of computing the mean annual rainfall from a short record by comparing it with a longer one at a neighbouring station is a well-known one. Although it is only of limited application in this instance, wherever it is possible to adopt it, it is likely to lead to more accurate results than would follow from accepting the uncorrected figures for the rainfall during short periods, which in some cases might lead to an error of quite 50 per cent.

The map (diagram 3) shows approximately the distribution of rainfall in parts of the Protectorate. Along the coast the rainfall diminishes fairly regularly from south to north. Between Mombasa and the German frontier there is a strip of country where the fall is over 50 inches; at Mombasa the average is 48 inches; the 40-inch isohyetal appears to cut the coast-line a few miles to the south of Malindi, the 30-inch somewhere near Lamu; whilst at Kismayu the mean annual rainfall is only 15 inches.

There is as yet no information with regard to that part of the interior of the country that lies to the north of the Sabaki river and to the east of the 38th degree of longitude. In the greater part of this country the rainfall must be extremely small. Proceeding inland from Mombasa, the rainfall diminishes fairly rapidly for about 60 miles. In the Taru desert it is under 30 inches per annum. The country to the north-east of the Uganda railway, between Makindu and Machakos,

has a rainfall of between 30 and 40 inches. On the south-west side there appears to be a fall of less than 30 inches. In all probability in the Nyeri desert there is a very small rainfall. The rainfall in the country around Kilimanjaro has not yet been determined. A gauge has recently been fixed at Taveta, which, so far as can be judged, is a dry place. The rainfall on parts of Kilimanjaro must be heavy, probably more so on the south than on the north side.

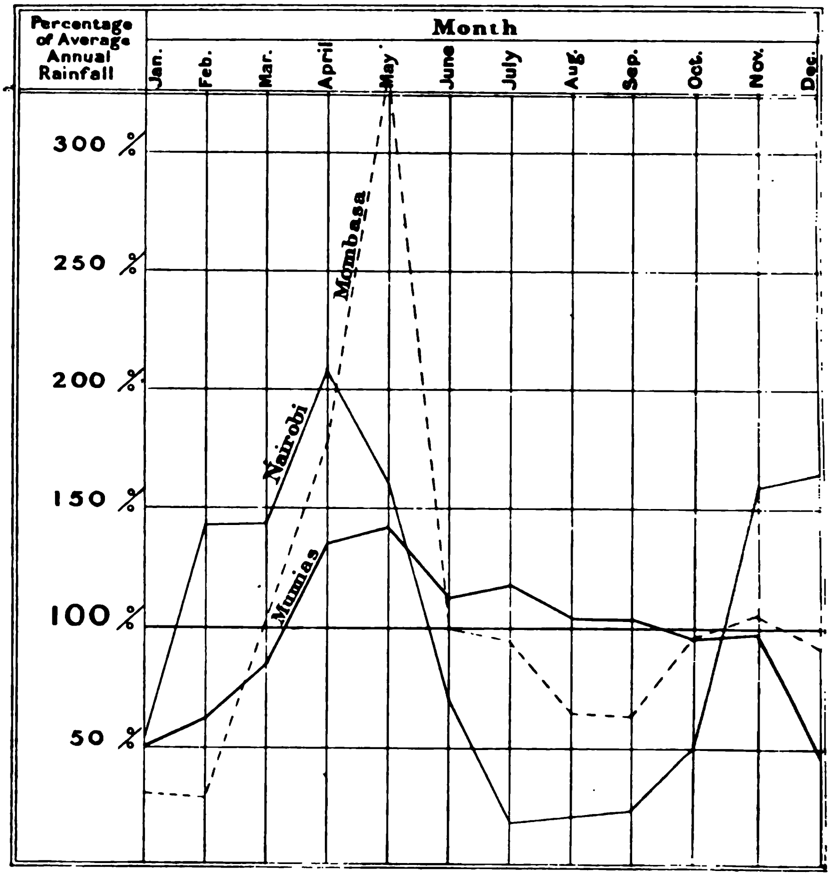


FIG. 2.—COMPARISON OF AVERAGE MONTHLY RAINFALL AT THREE STATIONS IN EAST AFRICA DURING THE SIX YEARS 1900–1905.

To the north-east of Nairobi there is a large extent of country, including both Mount Kenya and Mount Kinangop, with a rainfall of over 40 inches; and there can be little doubt that in some parts of this district the annual rainfall is very large. The Rift valley is, on the contrary, dry; the more southern portion, near Lake Magadi, has in all probability a rainfall of less than 20 inches per annum. The country between the Mau escarpment and the Victoria Nyanza is wet.

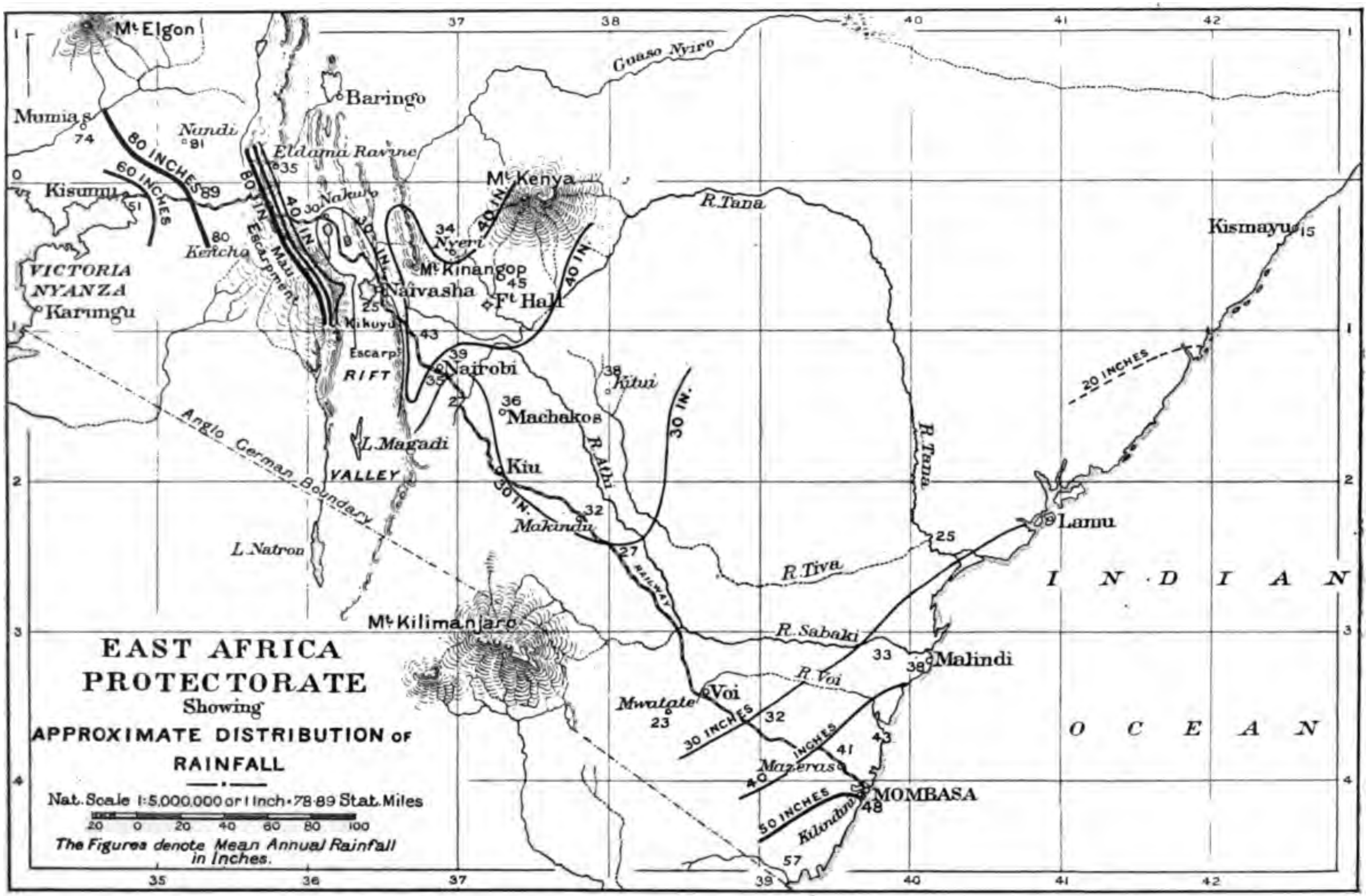


FIG. 3.—APPROXIMATE DISTRIBUTION OF RAINFALL IN BRITISH EAST AFRICA PROTECTORATE.

A large area seems to have a fall of over 80 inches, and it will not be surprising if some places in this district are found to have a rainfall of considerably more than 100 inches per annum.

Briefly, it may be said that there are three comparatively wet areas in the Protectorate—(1) a triangular strip around Mombasa; (2) the country to the north-east of Nairobi, including the greater part of the Kenya province; and (3) the district near the lake. The two latter wet areas are divided by the dry country at the bottom of the Rift valley. The actual extent of land in the Protectorate, with a rainfall of more than 40 inches per annum, cannot be determined until much fuller and more accurate information is available.

The distribution of rainfall in the district round Victoria Nyanza is still chiefly a matter of conjecture, and rain-gauges are much required along the shores in both directions from Kisumu, and also from the neighbouring mountains. There should be little difficulty in establishing a gauge at Karungu as a commencement, and as soon as the Nandi, Lumbwa, and Sotik districts are settled gauges will doubtless be fixed which will materially add to our knowledge of the distribution of the rainfall there. In the Rift valley gauges are especially required near Lake Magadi in the south, and at Baringo in the north.

In the central wet area information is necessary with regard to the rainfall on both sides of the Aberdare range, and on the slopes of Mount Kenya. At present there is no record of the rainfall at any point in the Protectorate at an elevation of more than 7500 feet above the sea. Other places where the gauges would be of scientific value would be on the slopes of Kilimanjaro, in the district between that mountain and the sea, and along the Tana river. It is impossible to expect that rain-gauges can be fixed in all these places at once, but there is no difficulty in some cases. Considering the importance from an agricultural point of view of having accurate rainfall statistics, it is much to be hoped that the Protectorate Government will greatly increase their number in the near future, and, whilst taking every opportunity of extending the area over which the recording stations are established, will also ensure that in every case the results are properly observed and recorded by an intelligent and a trustworthy person. The idea that this precaution is not invariably taken was suggested by a visit to an important station on the railway, where the gauge was found to be covered by a large flat iron plate so arranged that no water could find its way into the vessel inside. Although the time of year was at the end of the dry season, when rain was probably not much expected, this addition to the apparatus did not inspire much confidence in the observer.

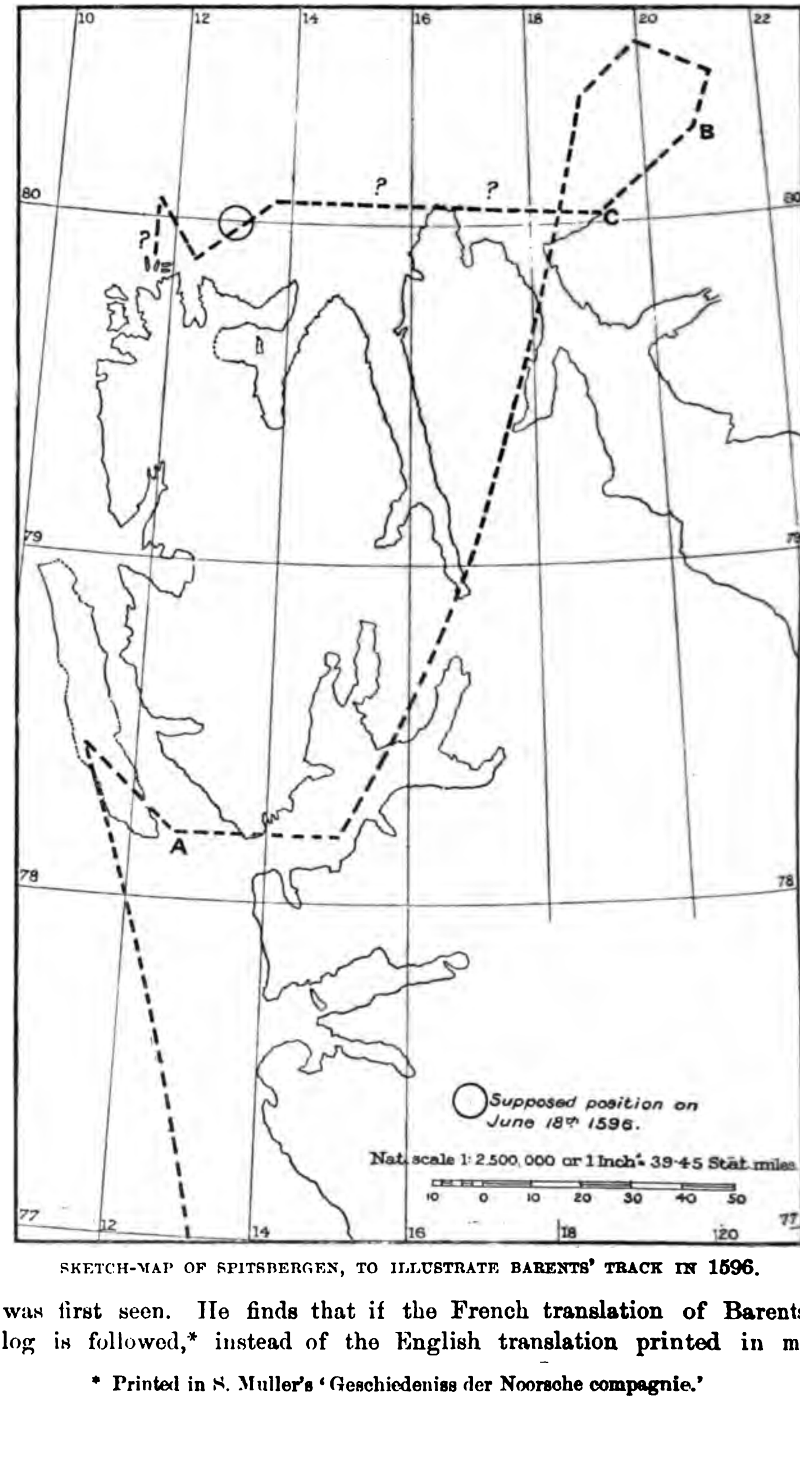
SPITSBERGEN.

By Sir MARTIN CONWAY.

In the summer of 1906 the Dutch Government sent a cruiser, the *Friesland*, to Spitsbergen. Smeerenburg was visited, and a stay of some duration made there for the purpose of putting in order the graves of the old Dutch whalers, so disrespectfully treated by visitors in recent years. They anchored in Hoeker (Virgo) bay. West of this, on the north-west coast of Danes island, they found two graveyards, whereof the one to the east belonged, according to tradition, to Frieslanders, the other to Danes. The principal Dutch graveyard was on Amsterdam island, on the east end of the north shore, and it was here that the Dutch ship *Willem Barents* set up a monument in 1878. Older than this burying-place was Deadman's island, probably only used in the earliest days of the fishery. There were also graves on the south shore of Amsterdam island, most of which were probably made after the abandonment of Smeerenburg. It was here that the captain of the *Friesland* caused all the remains to be brought together and buried in a single grave, on which a great heap of stones was piled and cemented together. Close to the still visible foundations of the Middelburg tent seven graves were discovered, probably those of the seven winterers of 1634–1635, who all died in that tent. Their skeletons also were removed to the new grave. A yet larger graveyard, containing some four hundred graves, was found on the opposite side of the bay, on the coast of the mainland. These appear to date from the eighteenth century, and to be later than the graves on Amsterdam island. One of these graves bore the date 1717. They were in good condition and unviolated, as tourists do not land there! All the names found there were Dutch.

Baron van Asbeck, who has sent us the account of the above expedition, adds some observations on matters connected with Spitsbergen history in the nature of addenda to my recently published 'No Man's Land.' The first of these is in connection with the Dutch winterings at Spitsbergen and Jan Mayen in 1633–34. It appears that in 1633 the future Admiral de Ruyter went up to Jan Mayen as mate of a whaler. In his journal, under date July 27, 1633, he notes that on this day "there came a jager (*i.e.* a ship to carry blubber, etc., to Holland) from Holland, and brought two men, one to stay on the island (Jan Mayen) with six men of the fleet to be enlisted by him, and the other to proceed to Spitsbergen to enlist there six more men. On July 29 the jager sailed for Spitsbergen with the 'burgher' (*i.e.* citizen) of Spitsbergen to stay there." These two men were evidently the leaders of the two wintering parties.

Baron van Asbeck has also been led to study carefully the recorded accounts of the voyage of discovery of Barents in 1596, when Spitsbergen



SKETCH-MAP OF SPITSBERGEN, TO ILLUSTRATE BARENTS' TRACK IN 1596.

was first seen. He finds that if the French translation of Barents' log is followed,* instead of the English translation printed in my

* Printed in S. Muller's 'Geschiedeniss der Noorsche compagnie.'

Hakluyt Society volume, 'Early Voyages to Spitsbergen,' the course actually steered by Barents' vessel can be explained. He has made out three sketches, on which he has laid down the courses, (1) according to 'Early Voyages;' (2) according to the French translation, (*a*) by dead reckoning, and (*b*) by dead reckoning corrected by the recorded observation for latitude of one point; and lastly, by (3) the track of 2 (*b*) with the positions of three known points corrected.

"The difference between the true latitudes and the dead reckoning," he explains, "shows us that from June 13 to 15 they experienced a northerly current of about $1\frac{3}{4}$ English miles an hour; from June 15 to 17 a northerly current of about 2 English miles an hour; and from June 17 (in 80° 10′) to June 18 (in 80°), having steered southerly courses for 16 miles and made 10′ south, a current of about 2 English miles an hour. The track (as drawn on the accompanying sketch) crosses the north-west corner of Spitsbergen.* It seems to me probable, not to say certain, that the current experienced was not a northerly one, but a north-westerly or a north-north-westerly, the trending of the west coast of Spitsbergen. Assuming the current to have been as supposed, with a velocity of nearly 2 English miles an hour, and that the bearing of the west headland on June 20, 1596, south-south-west 5 miles (= 20 English miles), was right, we have to fix the point *c* by computing the bearing and the current somewhere north-north-east of the Norway islands in a latitude of about 80° N."

Baron van Asbeck concludes that all the difficulties of laying down, from the recorded accounts, what was actually the course followed cannot be entirely overcome without a more exact knowledge of the currents in those parts.

ADMIRALTY SURVEYS DURING THE YEAR 1906.

By Rear-Admiral A. MOSTYN FIELD, F.R.S., Hydrographer.

UNDER the orders of the Lords Commissioners of the Admiralty, nine of His Majesty's vessels, with three small hired vessels, manned by 86 officers and 777 men, have been employed on hydrographical surveys both at home and abroad.

The Marine Survey of India, which is now in charge of an officer of the Royal Indian Marine, has been continued as in previous years.

A detailed report of Admiralty Surveys has been drawn up and presented to Parliament. The following is a brief summary:—

During the year 1906 no less than 367 rocks and shoals dangerous to navigation have been discovered, and during the same period 658 miles of coast-line have been charted, and an area of 2950 square miles has been sounded over by H.M. surveying vessels.

On the *East Coast of England*, at various places in the Medway and Thames

* Which, of course, the vessel cannot have done.

estuary, re-examinations were made of channels and reaches. The coast between Winterton and Covehithe was sounded off.

On the *South Coast*, the Portsmouth outer bar and harbour entrance were sounded out, and also a spoil ground off the Isle of Wight. A reported bank to the south-west of the Scilly islands was searched for unsuccessfully.

On the *East Coast of Ireland*, Long Island bank was resounded, and a new survey of Malahide inlet completed.

On the *coast of Scotland*, part of the Sound of Mull was resurveyed, and also Loch Snizort in Skye, while in the Orkney isles a large portion of Hoy sound was completed.

On the *coast of Newfoundland*, a triangulation was carried from Greenly island to Mekattina island, and some sounding carried out over this part.

Blanc Sablon was telegraphically connected with Ottawa observatory, and a meridian distance run to Twillingate from Blanc Sablon. Meridian distances were also determined between Bonne bay, Mekattina, and Greenly, and also between Twillingate and Bonne bay. A triangulation was carried from Cape Bauld to Canada bay. A shoal was searched for off Gull island, but a bank of 10½ fathoms only was found in this position.

On the *West Coast of Africa*, good progress was made with the survey of the coast of Liberia, and magnetic observations were obtained at various places in the Bights.

In *Borneo* the plan of Jesselton was extended north and south to Gaya head and Dumpil point respectively.

On the *China coast*, in the vicinity of Hongkong, a plan was completed from Chen Wan to Brothers point, including the Kap Sing Mun, and work in Mirs bay and near Waglan was also completed.

The coast survey between Lema islands and the Brothers has progressed, as well as a plan of Chauan bay. Port Swatow has been resounded.

In *British Columbian* waters. Port Simpson has been surveyed on an 8-inch scale, with the approaches on a smaller scale. A triangulation was carried from Port Simpson southward to Oval hill, and westward to Mount Lazaro. The triangulation from Chatham sound to Dixon entrance was extended to Cape Chacon, Alaska, and Towhill Graham island.

In *Australia*, part of the Hunter group, north-west coast of Tasmania, was surveyed, and a magnetic area near Betsy island, Storm bay, was examined. On the Queensland coast the survey was completed as far as 16° 45′ S., and the outer edge of the barrier reef on a smaller scale, including Trinity opening, between lats. 15° 48′ S. and 16° 43′ S.

In *Ceylon* the approaches to Colombo were surveyed, and the coast to the southward as far as Barberyn lighthouse completed. On the east coast, Trincomali harbour was resurveyed on an 8-inch scale.

The Marine Survey of India was responsible for a survey of the inner harbour and outer anchorage at Aden, part of the east coast of the Andamans, and a plan of the western entrance to Austin strait.

In the *Persian gulf*, the survey of Koweit was completed. A survey of the Arracan coast was commenced.

During the year the Hydrographic Department has published 116 new charts and plans, and 66 plates have had 84 new plans added to them, and 6050 corrections have been made to the chart plates.

The number of charts printed for the Government and the general public during the year was 86,868.

REVIEWS.

ASIA.

INDIA.

'The Native Races of the British Empire: Northern India.' By W. Crooke. London: Constable. 1907. *Price* 6*s*. *net*.

'The Khasis,' by Major P. R. T. Gurdon, Indian Army. London: David Nutt. 1907. *Price* 7*s*. 6*d*. *net*.

The days are happily past when to the British subaltern every native of India was a "nigger." At least those subalterns whose business it is to deal with native troops are required to know something of the origin and idiosyncrasies of the men they command, and very excellent little handbooks describing the various classes of fighting troops which make up the Indian Army are published by authority and pressed upon their attention. The result is that they do know something of their men, and that military interest in Northern Indian ethnography has been greatly stimulated. The pity is that no sufficient authority exists which might insist on similar studies on the part of those in England whose business it is to intermeddle with Indian affairs and hamper the progress of Indian administration.

In Mr. Crooke's volume, at any rate, they have a book which supplies a handy reference for all the more important conditions, ethnographical and social, of Indian humanity. It is a useful book of reference even for those who know India well, and for those who wish to acquire an elementary knowledge of Indian conditions of life it is invaluable. Its elementary character is a necessity induced by its brevity. On the whole, the author has collected a large store of useful facts into a small compass, and he has marshalled his facts in an interesting and most readable manner, but still the information given must be regarded as superficial; and the criticism must be added that some of the latest additions to ethnographical literature in India have apparently not been consulted. The census reports are, rightly, the author's chief sources of information, but such valuable works as those lately published on the fighting races of India, or Mr. Dane's pamphlet on the tribes of Baluchistan, to say nothing of Indian Survey reports, do not appear in the bibliography. Nor can we agree that within the narrow limits of a book of 262 pages the relative importance of the many nationalities with which the book concerns itself has been fairly preserved.

A great deal is written—and it is most interesting—about the Dravidian tribes, and the family of Gonds looms quite large in the book. Even so, not even the Gonds are fully described, for the subdivision of the family which occupies the Godavari basin and includes such sections as the Kois and Gotturs is omitted. It is true that so little has been done towards elucidating new facts and features in the ethnography of these strange people that the author has to go back to the days of Glasfurd for his authority. On the other hand, the Gurkhas occupy but a page or two at most, and of the many varied Baluch tribes there is hardly a sketch. The influence of Arab immigration and invasion on the ethnography of North-Western India, as well as of the Afghan element within the limits of the Indian peninsula, occupies no space at all.

The later chapters of the book are all excellent, and should help greatly to dissipate the many crude notions which exist, even amongst educated people, of the relative social status of the various castes, and give, at the same time, a good general idea of the life-conditions of the people. The illustrations are good, but not always quite apropos to the text. Why, for instance, should the Bhotiya of the

Himalayas appear amongst the Rajputs? But when all is said that might be said in criticism, there is no doubt that this is a book of great educational value.

In connection with the above we may notice a book written by Major P. Gurdon, of the Indian Army, on the Khasis—the tribes of the Khasia hills in Eastern India. The Khasis have attracted ample attention from Mr. Crooke in the book referred to above, although in economic importance amongst Indian peoples they are practically insignificant.

Major Gurdon is dealing with a subject which has evidently been a life-study with him. Since the days when Woodthorpe (one of whose sketches, by the way, is amongst the book illustrations) made the first systematic surveys of the Khasia and Garo hills, no one has given us so interesting a view of this strange wild country and the yet stranger people who inhabit it. For the Kasi race is a race apart; isolated in the midst of a surrounding Tibeto-Burman population; and it presents certain remarkable features in language and institutions which have attracted the attention of comparative philologists and ethnologists for some years. Sir Charles Lyall's introduction to the book sets out the present position of scientific inquiry respecting the Khasis, whilst the book itself is an epitome of their mode of life, customs, and superstitions with a very fair series of coloured illustrations showing the eccentricities of Khasi costume.

The fault of the book is the system of arrangement, which smacks too much of a Government report. There is no personal narrative—nothing of the excitement of adventure—in the book; and yet no man could have lived amongst these people, studying their ways, collecting their folklore, and fathering their interests with the Government of India, without encountering many incidents full of the romance of untutored nature—incidents such as leave delightful memories of strange personal experience, to be recalled tenderly in the after-days of life's eventide.

T. H. Holdich.

AFRICA.

Madagascar.

'Madagascar: Studien, Schilderungen und Erlebnisse.' By Haupt Graf zu Pappenheim. *With* 102 *Illustrations and* 6 *Maps.* Berlin: Dietrich Reimer (Ernst Vohsen). 1906.

Haupt Graf zu Pappenheim's 'Madagascar' is the outcome of three years' (June, 1902, to May, 1905) residence in that island, during which time the count made a close and sympathetic study of its peoples and institutions. He went out as the agent of an English shipping syndicate; later on he prospected for gold on his own account; and afterwards acted as leader of a large French party engaged in the south of the island. He did a good deal of topographical work in the province of Farafangana, and finally returned home, his work having been stopped by a native rising, and his health having suffered from the "murderous" climate, though by far the greater part of the island enjoys a climate suitable for Europeans. The first seven chapters (pp. 1–105) are a kind of encyclopædic survey of the country; the rest of the volume (pp. 106–356) is a lively record in journal form of the author's experiences and observations in his voyages round the coast and journeys through the south-east and east central provinces of the island. Possessing a mind quick to appreciate the humorous side of things, the lighter incidents of travel are by no means neglected. At the same time the writer manages to convey much solid information—largely on the economic condition of the land—in readable form. This is notably the case in the narrative part of the volume; the information in the opening chapters is clear, precise, and concise. Sections are devoted to history, physical features, climate, health, and mining, and special attention is paid to ethnology. The family life, religion, language, music, and culture generally of

various tribes are considered, while the large number of excellent photographs of different native types add materially to the value of this part of the work. As a convenient summary of the actual condition of the island the book is of distinct service; as an entertaining record of travel it should find many appreciative readers. An English translation would be welcome, though English readers may be glad to learn that Roman type is used in the present edition. The author proves himself a good linguist and a well-read man; the errors perpetrated in some of the English names given are perhaps due to the printers. On p. 117 we notice *Richard* Louis Stevenson; on p. 251 Prof. Shutterland (for Sutherland) Black; and on the very first page of the preface Sir William Davenant (the poet) appears as Davessant.

F. R. C.

AUSTRALASIA AND PACIFIC ISLANDS.

Australian History.

'The Coming of the British to Australia.' By Ida Lee (Mrs. C. B. Marriott). London: Longmans. 1906. *Price* 7*s.* 6*d. net.*

Being a narrative of the early colonization of Australia, and dealing with the first forty years (1788–1829), when transportation was in full swing, it is remarkable that the word "convict" is seldom used—but three or four times casually, and only once when referring to the early bushrangers is it directly mentioned: "Bands of convicts, many of whom were the settlers' own servants, . . . bade farewell to authority and took to the bush."

The book is written on other lines, and concerns the work of exploration and colonization. It deals first—after mentioning the visits of Dampier and Cook—with the expedition under Phillip, its call at Botany Bay just before the arrival there of the French ships *Boussole* and *Astrolabe* under La Pérouse, and its final settlement in Port Jackson at Sydney, at Farm Cove, and what is now called Circular Quay. The work of the several governors during this period, from Phillip to Darling, the direction of their energies, their virtues, failings, and failures are recorded. Much exploration was done during the reigns of Phillip, Hunter, Macquarie, and Darling. Macquarie, following Bligh, found the affairs of the colony in a state of chaos, and set them straight. Brisbane encouraged immigration, founded the Parramatta observatory, and imported some of the best Arabs to improve the breed of horses.

There is a short *résumé* of the many attempts that were made to cross the Blue mountains, and one who has been "bushed" at the foot of their precipices can fully appreciate the final success, in 1813, of Lawson, Blaxland, and Wentworth. From the first attempt by Governor Phillip in 1788, a period of a quarter of a century elapsed before success was attained. Once the barrier was crossed, the exploration by land of the east and south-east of Australia was rapid. Many exploring parties set out from Sydney, and the magnificent country from the Darling downs in Queensland to the mouth of the Murray in South Australia became known in a few years. With this work the names of Evans, Oxley, Allan Cunningham, Sturt, Hume, Hovell, and Mitchell are connected.

Of more importance in securing the whole of Australia for the British Empire were the expeditions and voyages by sea, for the French were active, and their vessels *Géographe* and *Naturaliste*, under Baudin, were in Australian seas. Phillip, Murray, Bass, and Flinders, the last two circumnavigating Tasmania, are household names in Australian geography, and their work was done before Flinders (who had already surveyed the whole of the south coast of Australia) fell in with the French expedition in Encounter bay.

A few pages are devoted to the aborigines—their characteristics and mode of life; their weapons, fishing, corobborees, and burials; their rock carving and paintings, of which drawings are reproduced from Sir George (then Captain) Grey's work, that represent what he saw when he landed on the north-west coast. A number of old drawings of aboriginals hunting, fishing, etc., are also reproduced, as well as old portraits of the early governors.

Some of the notes on the physical features at the beginning of the last chapter must not be taken too seriously.

W. B.

Pacific Islands.

'Hawaii, Ostmikronesien, und Samoa: Meine Zweite Südseereise (1897–1899) zum Studium der Atolle und ihrer Bewohner.' Von Prof. Dr. Augustin Krämer, Marine-Oberstabsarzt. Mit 20 Tafeln, 86 Abbildungen and 50 Figuren. Stuttgart: Strecker & Schröder. 1906. *Price* 10 *marks.*

The greater part of the time during which Dr. Krämer was engaged in zoological, geological, and more particularly ethnological investigations in the Pacific was spent in Samoa, and his well-known monograph, 'Die Samoa-Inseln,' appeared in two volumes in 1902. The present volume describes the rest of his travels, to which the name "Südseereise" is scarcely applicable, for they are mainly concerned with Hawaii and the Gilbert and Marshall groups.

The author describes his journey by Chili and Peru, through Guatemala to New Orleans, and from San Francisco to Hawaii. After a few weeks spent at Hawaii and Samoa, a visit was paid to the less frequented Marshall islands, landing at Jaluit (which he notes should be Jalut). Here everything lies packed so closely together on the little patch of coral, that a few hours sufficed to see all the sights of the island. "After three hours as a globe-trotter, I could say that I had seen all that was worth seeing, and quite enough of it; as *Forscher* I recognized that a rich field of work lay before me." An interesting account of the island follows, as also of some stick-charts (which are figured) of the group. The Gilberts were next visited, and two chapters contain accounts of the islands and inhabitants of the Makin and Peru groups, in which, amongst other matters, we find descriptions of several figures of the tattoo-patterns. After returning to the Marshalls, the author sailed for the little-known island of Nauru (Pleasant island), and records its geographical and ethnographical features. The homeward route was by Sydney, New Caledonia, and Fiji to Samoa.

It would appear from these investigations that the Gilberts show a closer connection with the West Carolines, in spite of the distance between them, than with their near neighbours, the Marshalls, while the latter have distinct affinities with the Eastern Carolines. The author hopes, during his third voyage to the South Seas, in which he is at present engaged, to throw more light on this interesting point.

A. C. Haddon.

POLAR REGIONS.

The Geographical Relations of Graham Land.

J. Gunnar Andersson, 'On the Geology of Graham Land.' Bulletin of the Geological Institution of the University of Upsala. Vol. 7, Nos. 13–14, pp. 19–71, pl. i.–vi.

During the voyage of the *Jason* in 1892–94, Captain Larsen made the first serious contribution to Antarctic palæontology. His collection was small, but very suggestive. Its chief value now, however, is due to the fact that it induced Dr Otto Nordenskjöld to select Seymour island and its neighbourhood as the field of operations of the Swedish Antarctic Expedition. The work of the expedition was

interrupted by dramatic adventures, and part of the collections were lost by the wreck of the *Antarctic;* nevertheless Dr. Nordenskjöld and his colleagues secured results which will make the record of their discoveries one of the primary documents in Antarctic literature.

Reiter's application of Suess's principles to the information about Antarctica available in 1888, led him to predict that Wilkes Land would be found to be of the Atlantic coast type, and Victoria Land and Graham Land of the Pacific type. The additional information collected regarding Victoria Land has left Reiter's conclusion as to the structure of that part of the Antarctic continent still open to doubt; but the work of the Swedish Antarctic Expedition has clearly established his view as to the structure and relations of Graham Land.

The Swedish expedition explored the islands and coasts of eastern Graham Land, which proves to be an area of great geological variety and complexity. The staff was fully competent to investigate its problems, as in addition to Dr. Nordenskjöld, himself a skilled geologist, it included Dr. J. Gunnar Andersson, the present Director of the Geological Survey of Sweden. He has now summarized the geological results of the expedition in a most interesting memoir, which has been written as a preliminary sketch to guide the palæontologists, who are describing the large collections of fossil plants and animals made by the expedition.

The localities studied in detail inclnded part of the South Orkneys, Hope bay at the north eastern end of Graham Land, and the archipelago of Ross island, Seymour island, Snow Hill island, and Lockyer island. The opposite side of Graham Land was investigated by the Belgian expedition, and the author pays a warm tribute of respect to the work of Dr. Arçtowski in that less fruitful geological field. Dr. Nordenskjöld and Dr. Andersson discovered representatives of a long series of fossiliferous rocks ranging from the Jurassic to the Pleistocene; they include Jurassic (apparently Bathonian) plant-beds; the Cretaceous system is represented by the Cenomanian, Turonian, and Senonian series, and the Cainozoic by Upper Oligocene or Lower Miocene, Pliocene, and recent shell-beds. In addition to the sedimentary rocks, there are Cainozoic basalts and tuffs, and a large area of plutonic rocks, including gabbros, augite-porphyrite, and quartz diorite; the last rock appears to be the most typical, and Dr. Nordenskjöld describes it as similar to that which he had previously studied along the American coasts of the Pacific, in Alaska, and in the Southern Andes. The age of these plutonic rocks is doubtful; no evidence of their intrusion into the Jurassic was seen; but as no fragments of these rocks could be found in the Jurassic conglomerates, the author is inclined to regard them as due to a Cretaceous intrusion.

The fossils have not yet been fully worked out, but Dr. Andersson tells us enough about them to show their extreme interest, and how instructive a light they throw on the geological history of the Antarctic. The Jurassic plants include species allied to those of Australia and Gondwanaland. The Cretaceous Ammonites, according to a short preliminary note by Prof. Kilian, are similar to those of the Neo-Cretaceous of India; one horizon corresponds to the Cenomanian beds of Ootatoor, and higher horizons represent the Turonian and Senonian. Cainozoic beds, which are referred to the Upper Oligocene or Lower Miocene, remind us that the great middle-Cainozoic marine transgression on to Southern Australia is still undecided between these two dates. The new fossils include a Zeuglodon, five extinct genera of penguins, and some most instructive fossil fish. A Pliocene horizon is probably represented by the Pecten conglomerate of Cockburn island.

The main geographical interest of this memoir is its evidence as to the tectonic structure of the area. Dr. Andersson shows that Graham Land and the adjacent archipelagoes include two divisions. A broken-up volcanic and sedimentary plateau

lies along the south-eastern coasts of Graham Land; and an area of folded rocks, including Jurassic sandstones and plutonic masses, forms the axis of Graham Land, the South Shetlands, and the South Orkneys. The folded belt is shown by its composition and geological history to be a geographical continuation of the fold-line of the Andes. The eastward trend of the fold-lines of the Andes, which, as Suess has shown, is one of the most striking features in the mountain system of the southern end of South America, does not, therefore, continue far into the Southern ocean. The line is bent sharply backward round a great gulf to the south of Terra del Fuego, and passes through the South Orkneys, the South Shetlands, and Graham Land on a course to the west, along the southern margin of the Pacific. How far it continues westward, and its relations to the mountains beside the Ross sea, are still uncertain; but the Swedish Antarctic Expedition has established the essential fact of the reflection of the Andean line through Graham Land, and has filled the most important remaining gap in coastal geography by its illuminating discoveries as to the structure and history of the southern coast of the Pacific. The fossil evidence as to the life of the Southern ocean in the latitude of 64° S., at intervals from Jurassic times to the present, is also an important addition to geological and geographical knowledge.

J. W. G.

GENERAL.

Gastaldi and the Cartography of America.

Stefano Grande, 'Le Carte d'America di Giacomo Gastaldi.' Turin: Carlo Clausen. 1905. *With Facsimiles. Price 6 lire.*

Prof. Grande, who in a previous work (*Journal*, vol. **21**, p. 561) did useful service in setting forth Gastaldi's general contributions to geographical knowledge, here deals in particular with the maps relating to America, which had not previously been subjected, as a whole, to systematic examination. They are considered in three groups, viz. those which accompanied the Venice Ptolemy of 1548; those prepared to illustrate Ramusio's great collection of voyages; and a number of maps issued separately. This arrangement is not strictly chronological, but is perhaps justified by the fact that the seven maps dealing in some way or another with America in the 1548 Ptolemy may be regarded as forming the first American atlas. Prof. Grande examines each map in turn, tracing as far as possible its sources, and comparing it with other contemporary maps. In many instances he is able to point to the great improvement introduced by Gastaldi as regards the extension in latitude (and sometimes also in longitude) of the countries delineated. He is perhaps inclined sometimes to exaggerate the comparative merits of his author. Thus he lays stress on the freedom displayed by Gastaldi from the fantastic notions prevalent regarding the relations of America with Asia, although the idea of a continuous land connection between the two is to be seen in all the general maps. Again, the correct representation of California as a peninsula was not an entire innovation on the part of Gastaldi, *e.g.* it is to be seen in Sebastian Cabot's planisphere of 1544. Strange to say, though generally well acquainted with previous writings on sixteenth-century cartography, the author seems to have no knowledge of the recently discovered Waldseemüller maps, which makes him attribute an original importance which they do not deserve to maps now known to be merely copied from these.

As regards the individual maps, that of South America, in the 1548 Ptolemy, is perhaps one in which Gastaldi's relative correctness is as well shown as in any, in spite of its small size. The maps in Ramusio's third volume show generally a greater elaboration than those in the Ptolemy, being based on the information supplied to Ramusio by his correspondence with Fracastoro and others. Thus the map of 'La Nuova Francia,' which embraces the coast of North America from

Florida to Labrador, embodies the information supplied by the anonymous 'Gran Capitano' of Ramusio (whom Prof. Grande, like Schefer, holds to have been Parmentier). Unlike previous commentators, Prof. Grande thinks that some knowledge of Cartier's discoveries is traceable in this. A good deal of space is devoted to the planisphere of 1546, which is certainly one of the most important of the series. The much-reduced facsimile is, however, too small to be legible, but the map had previously been shown in full size in the 'Remarkable Maps,' published by Muller of Amsterdam.

A Compendium of Geography.

'The World of To-day.' By A. R. Hope Moncrieff. London: The Gresham Publishing Company. 1905-6. Six volumes. *Maps, Diagrams, and Illustrations.*

It is a matter for satisfaction on several grounds that a work such as this should have been found worth the doing. Its title might suggest a geographical encyclopædia. It is not quite that. The sub-title describes it much more nearly—"A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce." The broad arrangement of the work is striking and wise. The flesh is separated from the bones, in this way—the text consists of a narrative account, for each country, of the features which might be supposed to interest the ordinary traveller, while in copious appendices there are furnished statistics, accompanied by many illustrative diagrams, dealing mainly with commerce, but also with other subjects; for example, we have chief rivers tabulated with their lengths, and other similar skeletonic geographical information. This arrangement leaves the narrative free of figures, which may be left alone or correlated with the text according to the inclination of the reader, and, incidentally, can be more readily revised if occasion should arise. As to the narrative, it is certainly not over-systematized in regard to arrangement, and the more serious student might cavil at some of its omissions; the author's object appears to have been to provide light descriptive reading of a popular character, with plenty of word-pictures of scenery and people, whether original or judiciously quoted. Perhaps he pursues this object a little too far; some, for example, may prefer to recognize the Empire under a more geographical name than "John Bull." It is pleasing to note, however, that information on isolated points is made accessible by a full index. As far as the work goes, then, it may be welcomed, save that in the last section, where the author moralizes briefly on the British isles, on the theory that his readers require less information here than elsewhere, we cannot pretend to find the slightest value. There is a certain archaic flavour about the scheme of maps, which includes colour-work far from worthy of Mr. Bartholomew, whose name it bears; the unintelligible but not uncommon practice of providing ordinary sketch-maps for territory also mapped more fully in colour is followed in several cases, whereas there is no attempt at systematic physical map-work even in black and white. The photographs are plentiful and well reproduced, and must have been drawn from so many sources that they form a very notable collection. A few of the coloured plates are effective; of the majority, it is only to be hoped that they do injustice to scenes which one has been taught to believe beautiful. The whole work leaves a feeling that if all concerned in it had gone a little further it might have fared very much better.

O. J. R. H.

THE MONTHLY RECORD.

EUROPE.

The Storms of February, 1907.—The following is a report from Vienna on the late destructive storms: As early as February 16 and 17 low temperatures, several degrees below freezing-point, along with high atmospheric pressure, prevailed in Central Europe. Meanwhile there passed over the north of Europe depressions of no especial intensity, bringing light west winds with rising temperature. A decisive change in the character of the weather could, however, not yet be notified. Not till February 20 did thaw fairly set in. Over Southern Sweden and its bordering seas an unusually deep depression had been reached; its lowest isobar showed 705 millimetres (27·7 inches), an atmospheric pressure of extremely rare occurrence at sea-level, the lowest hitherto observed at this level amounting to 690 millimetres (27·2 inches). Round such a minimum the wind revolves, in consequence of the Earth's rotation, in a direction contrary to that of the hands of the clock. The greater the difference of atmospheric pressure within a determinate area so much stronger the wind blowing over it. Now, on February 20 the difference of pressure between Sweden and the Netherlands amounted to 75 millimetres. This steep gradient gave rise, accordingly, on the Dutch coast, to a hurricane from the west, corresponding with the rotation round the depression lying further north. The velocity of the storm amounted to 114 to 165 feet per second, *i.e.* 68 to 97 nautical miles an hour—a velocity to be characterized, according to the scale of velocities of wind, as a "hurricane unroofing houses, throwing down strongly built chimneys, sweeping away heavy walls," etc. The storm lasted over twenty-four hours, and drove the steamer *Berlin* irresistibly against the fatal pier of the Hook of Holland. A circumstance specially fatal to the ship was the fact that the storm had been raging so long before. Owing to the situation of the minimum of atmospheric pressure, the wind came from the north and veered to the east, so that it blew in full force throughout a space of more than 500 nautical miles over an unimpeded sea. The wave-impact must, therefore, have far exceeded that of a storm of the same magnitude but wanting such accumulation of momentum. While the depression in the north was far from being counterbalanced elsewhere, a partial depression was formed on February 21 over the Adriatic, giving rise to a severe storm in the Mediterranean. To this storm, coupled with extremely hazy weather, the Austrian Lloyd's ship *Imperator* fell a sacrifice, being wrecked on the coast of Crete.

Slav and Low German Place-names in Germany.—In two recent works Herren Kühnel and Mucke set themselves the task of estimating the amount of the Slav contribution to the geographical nomenclature of the Hanoverian Wendland. In a review of these works, the *Deutsche Erde* (No. 1, 1905) highly appreciated their labours, yet observed how, from an inadequate acquaintance with the Low German geographical nomenclature, the authors had over-estimated the Slav element. A more recent article in *Deutsche Erde* (No. 6, 1906) shows how much the authors have underestimated the Low German contribution to the nomenclature of the Lüneburg localities. Following the trail of Low German in the geographical nomenclature of the Slav regions of Germany, the article further shows how notably the intrusive Low German has relabelled the localities of Slav lands. The etymology of place-names, worn down and distorted as they are, is recognized to offer a task calling for the wariest circumspection and a judgment proof against pitfalls. *Bomke* (in documents *Bombeke*), referred by the above authors to Slav *babik*, is, in fact, L.G. *bôm* + *beke* = H.G. *Baumbach*, a name of frequent

occurrence—*e.g.* in Westphalia and the Old Mark. *Lindow*, *Bernow*, *Sandow*, *Berkenow*, again, are all pure German names of wide dispersion, *ow* being but the Slav adaptation of *au*. *Rychnov* (in Bohemia) = *Reichenau*; *Plumlov* (Moravia) = *Blumenau*. With the German colonists German place-names also migrated far into Slav lands, where the names emerge with a more or less Slav twist. From fifty to one hundred family names is all the legacy left by the Wends in the nomenclature of Mecklenburg. On the Saale and east of it numerous Low German colonies have imposed German names on Slav territory. Halle (salt works) is a Low German name occurring ten times in Westphalia. *Brandenburg*, carried back in Meyer's 'Conversations-Lexicon' and in Carlyle's 'Frederick,' to the Wendish Brennabor (a name, too, stamped on cycles made in Brandenburg), is shown to be of purely German origin. "Brambor" is but a Slav transformation of Brandenburg.

Historical Atlas of the Alpine Provinces of Austria.—This atlas, which owed its inception to Eduard Richter, has now entered on publication under the auspices of the Imperial Academy of Sciences in Vienna. The part already to hand shows how valuable will be the cartographic work, not only for historical research, but likewise for the solution and study of questions in the province of political as also of cultural geography. The first division of the whole work will be devoted to the representation of the historical development of the boundaries of the jurisdiction of the Supreme Court, and is to comprise thirty-seven maps, eleven of them are now out, embracing the provinces of Salzburg, Upper Austria, and Styria. The maps, which have been prepared by the Vienna Military Geographical Institute, conform to the plan of the general map of Middle Europe, and are therefore on the scale of 1 : 200,000. The ground is shown by means of hachures in brown; rivers and lakes in blue; places and letterpress black; the frontiers in black and red. An elucidatory part is added, the introduction to which is from the pen of Eduard Richter himself. To him is also due the elaboration of the maps of Salzburg, with the division into provincial courts, and the accompanying elucidative text. Oswald Redlich, who has been elected superintendent of the Academic Atlas Commission in succession to Richter, concludes the introduction. The cartographic work differs essentially from the great mass of historical atlases or maps. Instead of presenting the situation at a particular moment of the past in the politico-administrative development of the land, it brings to view, always in one representation, the provincial court distribution in its transition from mediæval to modern times. Occasionally it gives, simultaneously, a representation of the situation towards the end of the eighteenth century, down to which time the old conditions had pretty fairly maintained themselves. It is only since the time of the Emperor Joseph II. —in Salzburg since 1803—that dislocations of greater moment have taken place. In this atlas the ground is regarded as a feature to be kept in view throughout. "Even in the smallest patch represented," says Richter, "the student should be able to form for himself a notion of the character of the spot of earth he sees before him." The frontiers as they stood towards 1800 are brought out in red print. Of place, river, and mountain names, only such are taken into account as were of importance for the development of the provincial courts and of the "Bourgfriede" (jurisdiction in and around a castle). The "Territories" of the princely dynasties of the later Middle Ages are constituted of such provincial courts. A characteristic of their development from the thirteenth to the eighteenth century is their successive diminution through division. The next part of the work will present the development of the ecclesiastical distribution of the Austrian Alpine lands.

ASIA.

Prof. Huntington on Lob Nor.—We alluded briefly, about a year ago, to Prof. Ellsworth Huntington's visit to the Lob Nor region, during which he for the first time crossed the whole width of the desert plain to the east of the present position of the lake. A graphic account of the journey, followed by a discussion of the problem of the physical history of the lake-basin, has appeared in the *Bulletin of the American Geographical Society* for February and March, 1907. It will be remembered that the journey involved considerable risks and hardships, being made in the depth of winter, with a temperature frequently many degrees below zero Fahr., while to the scarcity of fuel and water-supply (for the latter it was necessary to load the camels with blocks of ice dug out of the marshes) was added the exceedingly difficult nature of the ground. The whole plain was seen to be merely the ancient bed of a much more extensive lake, and its surface was largely composed of salt deposits, the surface being likened by Prof. Huntington to the choppiest sort of sea with white caps a foot or two high, frozen solid. Sometimes the salt took the form of pentagonal prisms, from 5 to 12 feet in diameter. The old Chinese tales of bottomless mire, in which horse and rider might totally disappear, received some confirmation, the plain occasionally forming hollows where the soil was damp and comparatively smooth, which it was risky to venture over. On one occasion the camel which the traveller was riding broke through the saline crust, and sank a yard deep into soft oozy muck, being extricated only with difficulty. On the northern border of the basin, the surface displayed an alternation of æolian "mesas" of clay (in the form of elevated peninsulas or elongated islands), with bays and sounds of similar dimensions, all with their axes running north-east and south-west. Prof. Huntington regards the hollows as having been carved out by the wind during a dry epoch preceding the last marked expansion of the lake. Elsewhere the party travelled over a fantastic red plain—the soft, dry bed of an older expansion of the lake—glittering with gypsum crystals, and sparsely studded with mesas of pink and greenish clay. For 100 miles the only signs of life in the whole plain had consisted in a plover, half buried in the salt, and dead for centuries, and the deeply buried roots of some reeds which must have flourished in the expanded Lob Nor of one of the Glacial epochs. As regards the past history of the region, Prof. Huntington takes a view differing from those both of Prjevalsky and Hedin, though containing elements of both. The existing Kara-Koshun swamp is, he thinks, the small modern remnant of a large ancient Lob Nor, but between the third and eighth centuries of our era the lake seems to have occupied the position assigned to it on old Chinese maps, about a degree north of Kara-Koshun. In travelling round the basin, Prof. Huntington found that it is surrounded by terraces and by deposits which show an alternation of aqueous and sub-aërial conditions, which, in conjunction with similar phenomena noticed both in Turfan and Seistan, indicates, in the writer's opinion, that the climate of recent geological times has been much more variable than is generally supposed. Six different lacustrine strands were found, lying at varying levels above the modern Kara-Koshun. The change in the position of the lake seems rather due to changes in the course of the Tarim than *vice versâ.* Unlike Hedin, Prof. Huntington believes that in the Middle Ages Lob Nor was decidedly larger than now, and he points to the existence of two old roads, skirting the abandoned shore, which involve a two days' waterless journey, and could hardly have been used if the shorter modern route had been practicable.

AFRICA.

Altitude of Khartum.—During the last eighteen months a duplicate line of levels has been carried from Khartum to Wadi Halfa in connection with the survey

of possible reservoir sites in this reach of the Nile. The altitude of Khartum above mean sea-level at Alexandria may be taken as 382 metres (1252 feet). The actual results are—

Place.	Metres above sea-level.	Authority.
Zero of Nile gauge, Wadi Halfa	116·70	Willcocks.
Bench mark at Abu Fatma	230·70	Survey Department.
Bench mark at Jebel Barkal	256·59	" "
Bench mark at Abu Hamed	310·79	" "
Top of Berber gauge	346·95	" "
Zero Khartum gauge	364·37	" "

The zero of the Khartum Nile gauge is about 10 metres below mean low stage, and the mean range of the flood is about 5·5 metres, so high and low flood-level at Khartum are about 374·4 and 380·9 metres above sea-level. The bank-level is about 382 metres above sea-level. Bench marks were fixed every 10 kilometres, and the values of these, together with their descriptions, will shortly be published.

The Climate of Eritrea.—An article in the *Rivista Coloniale*, a new Italian periodical treating of colonial questions, sums up in a useful way our knowledge of the climatic conditions of the Italian possession on the Red sea. Its author is Captain Tancredi, who explains the varying climatic conditions of the several parts of the territory as resulting from their position or relief. The data for the study consist of observations from fourteen different stations, mostly dating only from the last few years, though in the case of Massaua and Kassala there are unbroken series extending over ten and eight years respectively. The writer points out that the division of zones of altitude corresponding to the popular usage in Abyssinia, the limits of which were laid down by Dove in his work on the climate of that country, will not hold for Eritrea, owing to the marked difference between the seaboard strip up to about 500 metres (1650 feet) (the Sambar of the natives) and the zone immediately above it. His main divisions, therefore, are (1) the coast zone, (2) the zone of the valleys and escarpments, (3) that of the high plateau and alpine summits. In the first the conditions are extremely trying to Europeans by reason of the great heat and atmospheric humidity, the latter reaching its maximum in the months of June, September, and October. As a rule rain falls in the winter months only (November to April). The second zone falls within the *régime* of summer monsoon rains, but those portions which adjoin the coast zone enjoy the benefit of some winter rains as well. This makes it necessary to subdivide the zone according as the slopes face the sea-board or the Sudan. The soil is fertile, and the water-supply renders vegetation both rich and varied. In the seaboard subdivision the most diverse products are capable of cultivation, according to altitude, but the conditions cannot be said to be favourable to European settlement. On the continental slopes of this zone, which form about three-fifths of the whole area of Eritrea, the climate is more propitious owing to the comparative dryness and greater variations of temperature due to nocturnal radiation. May is here the hottest month, and August the most rainy. The lower levels have a less copious rainfall, but as a set-off to this the possibilities of irrigation are greater, as the streams, which at higher levels flow far below the surface, here emerge on to less permeable strata. The third zone, above 1900 metres (about 6250 feet), includes only a small portion of Eritrean territory, within which the highest altitude is about 3100 metres (10,000 feet), and the highest permanently inhabited spot about 2600 metres (8500 feet). The bulk of the rainfall falls in summer (monsoon

rain), but a certain amount also falls in early spring. The greatest heat occurs in the dry season (November to May), during which vegetation rests, especially above 2400 metres (about 7850 feet), at which level the zone may be divided into two sub-zones of somewhat different character. The article gives full details as to average or extreme temperatures, rainfall, *régime* of the winds, etc., within the several zones.

The Frontier between the Kamerun and French Congo.—The surveys for the delimitation of this frontier, which has engaged the attention of the two Governments concerned for some years, have now been completed, the two commissions which went out in 1905 to work on the eastern and southern portions respectively, having lately completed their labours. They were not the first to take the matter in hand, for in 1900–1902 the precise determination of positions at the two extremities of the southern part of the frontier was effected by the joint commission under Captain Engelhardt and Dr. Cureau, the cartographical results of which were for the first time fully described by Prof. Ambronn in the *Mitteilungen aus den Deutschen Schutzgebieten*, 1906, No. 3 (see also a summary by Max Moisel in *Globus*, vol. **90**, No. 18). The chief work done by this commission was the determination of the points at which the boundary cuts the 10th and 15th meridians east of Greenwich, and of the precise parallel of latitude on which the course of the Campo intersect the 10th meridian, this parallel forming the southern boundary of the Kamerun for the greater part of its length. Valuable topographical surveys were also carried out, but no attempt was made to demarcate the frontier where formed by the above-mentioned parallel, which worked out as 2° 10′ 20″ N. The immediate occasion for the resumption of the surveys was the conflict which took place on the eastern frontier regarding the ownership of the village of Missum-Missum, and it was at first contemplated to survey only the southern portion of that frontier, from the Sanga to Kunde. The operations were, however, extended so as to embrace the survey of the whole frontier, both on the east and south. In the former direction the chief commissioners were Commandant Moll (on the French side), and Baron von Seefried (acting for Germany); in the latter, Captain Cottes (French), and Captain Förster (German). Some account of the work of the French parties (which went out together to Wesso on the Sanga, there separating for their respective tasks), is given in the *Questions Diplomatiques et Coloniales*, April 1 and 16, 1907. In the case of the eastern Kamerun frontier, some difficulties were experienced when the northern section was reached, inhabited as it was by natives who had hardly at all been brought under European influence. In particular the passage from the region of manioc to that of millet involved difficulties by reason of the unwillingness of the inhabitants to pass, as porters, from one to the other. The physical character of the two regions differed, the millet country being badly supplied with water, while small-pox was rife in it. But Lake Chad was eventually reached in safety. The work of the commissions has produced valuable results as regards the general knowledge of the country, its people and productions, and much light has been thrown, in particular, on the hydrography of the northern part of the Ogowe basin and adjacent areas to the north, previously known more or less vaguely from the work of Crampel, Fourneau, Lesieur, and others.

AMERICA.

Areas of the United States.—To do away with the discrepancy between the statements published in 1881 by the Census, and 1899 by the General Land Office, as to the areas integral and divisional of the United States, three officials, representing these two offices and the Geological Survey, have, after some months' collaboration,

arrived at an identical determination published in *Bulletin* No. 302 of the United States Geological Survey. This gives the United States proper a total land area of 2,974,159 sq. miles, or $\frac{3}{10000}$ (1188 sq. miles) more than the Census Office's estimate in 1881. Including water surface and outlying possessions, the total area amounts to 3,743,344 sq. miles. Area computation, however, involves questions of inclusion or exclusion of bays and estuaries, coastal sea-strip, and strips of the great lakes. The boundaries of a few of the States, again, have not yet been accurately mapped, and the situation of the coast-line of Alaska is still imperfectly known. Subject likewise to such modification as more accurate charts may call for, are the areas set down for the Philippine islands, Guam, Samoa, and the Panama canal strip. Nor does the total area above given take account of the claims of the States bordering the great lakes to shares in their waters. Approximate estimates of such shares are separately tabled. Nor does it include the claims of California and Oregon to jurisdiction over strips of Pacific waters, nor of Texas to jurisdiction over a strip of Gulf water.

Earthquake in Mexico.—At about 11.30 p.m. local time, or about 6 a.m. Greenwich time, on April 14 last, a very severe earthquake was experienced over the greater part of Mexico. The earliest accounts reported an interruption of railway communication between Mexico city and the east coast, and it is not impossible that there may have been a minor centre of disturbance in this region. No further confirmation of this report has, however, appeared, and the fuller details which came in later showed that the centre of violence and destruction lay along the west coast from Acapulco to Salina Cruz, a portion of the former town having been submerged. The principal focus seems, therefore, to have been submarine, in a region where seaquakes are common, and not infrequently reported by ships, though not felt on shore. The shock was severe, but not severe enough to cause damage, at San Luis Potosi and Juan Batista, cities which lie about 500 miles apart and 350 miles from the region of greatest violence; from this it is probable that the area over which the shock was, or could have been, felt, extended to some 500 miles from the centre. After making every allowance for irregularity in the outline of the seismic area, this must have reached an extent of 125,000 to 150,000 square miles.

Currents in the Gulf of Mexico.—The exact *régime* of the circulation of water at the fountain head of the Gulf Stream in the Gulf of Mexico seems only recently to have been thoroughly elucidated. During the last two or three years an effort has been made, under the direction of Lieut. J. C. Soley, chief of the New Orleans branch of the United States Hydrographical Office, to obtain more accurate data from the captains of ships, who were asked to keep a record, during their voyages across the gulf, of the ship's position, direction and strength of the wind, direction and strength of the current, and of the temperature and colour of the water. Lieut. Soley has communicated the preliminary results of this investigation to the *Annalen der Hydrographie*, 1907, pt. 2. He says that on plotting the data in a series of monthly charts, a surprising agreement was shown between those obtained from various sources, so that he is able to sketch the *régime* of the circulation with some minuteness. As is well known, the Gulf of Mexico is a deep basin, filled in the centre with cold water, and communicating with the ocean by two comparatively narrow channels. On entering this basin by the deep Yucatan channel, the water of the equatorial current divides into three branches, the most important of which makes a sweep to the west, north, and east, round the inner side of the basin, before making its exit by the Florida strait. The stream follows a well-defined course determined by the sudden, almost wall-like drop of the gulf-floor between 100 and 1000 fathoms. Except under special conditions, the current

does not affect the water where shallower than 100 fathoms. Of the other branches, one flows direct to the Florida strait in a north-easterly direction, while the other flows north and north-west, joining the main branch off the mouth of the Mississippi. There are two main counter-currents, the one flowing east along the north coast of Cuba, the other west from the Mississippi's mouth, between the main current and the north-west shore of the gulf. In the centre and west of the gulf, there are two areas of virtually still water, marked by a low surface temperature. Lieut. Soley points out that there are no true tides in the gulf, changes of level being brought about by wind-action. This is able to temporarily change the rate or direction of the current; thus a northerly gale causes the main current to flow over the Campeachy bank and close to the Mexican shore. The effect of the seasons is also noticeable, the course of the currents sketched above being what may be called the normal one, which suffers disturbance during the hurricane months from September to November. The effect of high water in the Mississippi in April and May is to increase the strength of the westerly counter-current, while the flood-water from the South Pass joins the main current and causes it to bend to the south-east. The water of all the rivers which enter the gulf tends to be deflected to the right, causing the formation of sandbanks on the west or south of their mouths. The writer attributes all the currents to differences of density, and lays stress on the fact that the water always seeks the path of least resistance.

AUSTRALASIA AND PACIFIC.

Journey across Western Australia.—An interesting journey north-eastwards across Western Australia, through the country known as Gibson's desert and the Great Sandy desert, was made in the latter half of last year by an official expedition under Mr. A. W. Canning, of the West Australian Survey Department. A detailed itinerary and report on the results of the journey appear in the *Western Mail* of April 6. Mr. Canning's instructions were to try to map out a practicable stock route between the eastern goldfields of Western Australia and the pasture-lands of the Kimberley division in the north. With a number of assistants, and twenty-three camels and two horses, he set out from Wiluna, in the East Murchison goldfield, at the end of May, 1906, and completed the traverse of the desert without mishap after a journey of several months. Proceeding by way of Lake Naberu, Lake Disappointment, and Godfrey's tank (the position of which is reported to be wrongly indicated on the maps), the party eventually reached a pool in Sturt's creek in 19° 53′ 52″ S. lat. From here they continued up the creek, making a careful compass traverse as far as its junction with the Wolf, and finally crossed over from Flora valley to the telegraph station at Hall's creek. Mr. Canning reports that in and near the Sturt there is a great deal of good pastoral country; in fact, the country is described as good all the way. Much of it is typically Australian, and Mr. Canning makes frequent reference to sandhills, mulga scrub, and spinifex. He declares, however, that the amount of water found in the centre of the desert at a shallow depth was a revelation to him, and he has every confidence that a well-watered stock route can be marked out from Wiluna to Sturt's creek, providing fair feed for travelling cattle over a considerable portion of the distance. The natives encountered during the journey were of great assistance to the expedition, readily pointing out existing sources of water-supply. According to native accounts, the season was exceptionally dry, and Mr. Canning's experience of the practicability of the route is therefore the more noteworthy. All the camels and horses completed the journey, and were in fair condition at the end. Plans of the route have been plotted upon the scale both of 1 inch to the mile, and 1 inch to 300 chains; and on the return journey, Mr. Canning (whose report is dated January 10, and was sent to

Perth by sea—hoped to be able to explore more of the country on either side, with a view to determining precisely the best line for the proposed stock route.

German Surveys in the Western Pacific.—Results of great interest as regards the morphological features of the Western Pacific have been obtained from extensive series of soundings taken in connection with the laying of submarine cables from Menado in Northern Celebes to Yap and Guam, and from Yap to Shanghai. The observations have been worked up at the German Hydrographical Office, and issued in its publication entitled *Aus dem Archiv der Deutschen Seewarte* (Jahrg. 29, Heft 2, 1906), while a *résumé* of the results has appeared in the *Annalen der Hydrographie* (1907, Heft 3) from the pen of Prof. G. Schott, one of the authors of the larger memoir. The soundings numbered 675 in all, and were not restricted to the direct lines joining the places named, but covered a zone with a breadth, in places, of over 50 nautical miles. A good deal of light has therefore been thrown on the configuration of the ocean floor, which proves to be astonishingly complex in this region, though a certain regularity may be traced in the very variety of the relief. The most striking feature is the existence of a series of deep troughs, running in more or less parallel directions, and occurring regularly on the outer or oceanic side of the principal groups of islands—the Liu-kiu, Marianne, Pelew, and Talau islands (the last lying to the north-north-east of Celebes). Prof. Schott gives a table summarizing the morphological features brought to light as regards the width of the lines of elevation and depression, the angle of the slopes between them, and so forth. He points out that there is a regular succession from west to east of island, trough, and horst, ending in a renewed though more gradual fall to the general oceanic depths. The term "horst" is adopted by reason of the apparent analogy with the geological feature so named, and the writer considers it highly probable that the morphology of the region is due to a great series of dislocations, such as might be expected to occur on the outer margin of a continental mass. It is not quite clear whether the island groups themselves are also to be regarded as horsts, the term being actually applied only to the areas with relatively shallower water which immediately follow the deep troughs as we proceed from west to east. An inspection of the bathymetric charts annexed to the paper seems to show, however, that these shallower areas in each case represent the tailing off, to the south, of the next outer line of islands, the most pronounced portions of the successive elevations and depressions occurring, not in a direction at right angles to their own trend, but, as it were, *en échelon*. The more gradual angle of slope in the case of the horsts (which would seem to be one, at least, of Prof. Schott's reasons for differentiating them from the above-water portions of the surface) would thus be a natural accompaniment of the lower altitude of these parts of the lines of elevation. In every case the steepest submarine slope is that immediately preceding the trough as we proceed to the latter from the side of the island. But even here the average only reaches 8½° (or 1 in 6·7), though a maximum of 18·6° (or 1 in 3) occurs in the case of the Yap trough.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Influence of Surface Waters on Ground Water.—It is a disputed question how far streams or other surface waters may influence the conditions of the ground-water stratum in the districts in which they occur. The question is of some practical importance, inasmuch as, if the level of the ground water can be shown to be in any great measure dependent on neighbouring streams, any diversion of the latter or diminution of the amount of water carried may injuriously affect the wells of the district. Such a case lately occurred near the shores of the Lake of Constance, where the level of the water in wells seemed to be lowered in consequence of the

diversion of a portion of the water of the Bregenzer Ach. This led Prof. Kastner of Salzburg to make a careful investigation of the subject, both by observations on the spot and by means of laboratory experiments, and the results have been put forward in a paper of some length printed in the *Mitteilungen* of the Vienna Geographical Society (1906, Nos. 11 and 12). It is impossible to describe in detail the methods employed by Prof. Kastner or the somewhat complex discussion of the physical principles involved. Having first proved to his satisfaction that the river water does percolate through the deposits over which it flows, and that these are not, as is often held, rendered impermeable by the mud laid down on the river-bed, Prof. Kastner studied the probable action of the river water on the ground water by means of experiments with glass tubes, partially filled with river sand, through which a constant stream of water was permitted to flow. In this way he was able to elucidate the possible action of the river water in pounding up the ground water by means of the pressure exerted by it through the permeable deposits, and further light was thrown on this action by a study of the conditions under which the water of one stream is held up by that of another. Direct observation on the ground proved without a doubt that a definite relation exists between the river water and ground water, the fluctuations of level of the two being in almost complete agreement. It was ascertained that, as regards chemical composition, the wells nearest the river showed a somewhat closer agreement with the latter than those at a greater distance, and this would seem to favour the view that the action is that of direct filtration. Prof. Kastner shows, however, that there are important reasons for inclining to the opinion that the rise in the level of the ground water may be due, in part at least, to impounding as a result of pressure. He concludes by pointing out the practical importance of recognizing how deleterious matters contained in the soil may in this way be brought up to the surface and favour the spread of disease.

Stereoscopic Colouring of Maps.—That the progress in map making, due to the attainment of a plastic effect by means of colours, is comparable to that brought about in the case of landscape pictures by Wheatstone's stereoscope, receives unexpected support from investigations, of which Dr. Eduard Brückner, Albrecht Penck's successor in the geographical chair at Vienna, is about to publish an account. Careful researches have lately been made by his brother, ophthalmologist at Würzburg University, into the phenomenon, known even to the ancients, by which certain colours appear to stand out in front of others, *e.g.* the reddish before the bluish colours in the spectrum, and these researches have established the fact that the appearance rests on a physiologico-optical process strictly analogous, *mutatis mutandis*, to stereoscopic vision. It has hitherto been assumed that the phenomenon of outstanding and receding colours was monocular, to be interpreted as a phenomenon of accommodation on the part of the single eye due to the dispersion of colours in its lens, which, unlike the lenses of our photographic cameras and telescopes, is not achromatic. But Brückner demonstrates the binocular character of chromato-stereoscopic vision. It was in Vienna that the endeavour to give a plastic representation in maps by means of colours first found expression, both in theory and practice, for as early as 1830 Ritter von Hauslab attained the desired end by using series of colours arranged according to the degree in which they presented the appearance of rising or falling relatively to the datum plane of the picture. In 1842 he put forward his idea before a scientific assembly in Graz. The law of colour-representation ran: "the higher the darker," analogous to the well-known rule "the steeper the darker" in Lehmann's system of hachures for military maps. It was in 1898, once more in Vienna, that this artificial rule gave place to the natural law of advancing and receding colours, the effect of which is, moreover, considerably accentuated by "adaptation," *i.e.* the contraction of the pupil in viewing vivid, its dilation in viewing

dull, colours. The precise scale adopted by the younger school of cartographers in Vienna for hypsometric representation therefore employs pigments in the order of the spectrum, from blue-green to orange-red, but with an abatement of brightness and intensity in the individual tones proportional to the depth of the area represented. The low-lying areas are accordingly shown by a pale or dull blue-green (grey-green), whence the land rises through pale yellowish-green and yellow (chamois) to brownish and red-brown, culminating in a vivid brownish-red. A characteristic of this chromatostereoscopic effect is that it at once admits of combination with a system of shading, whether with oblique or with perpendicular illumination. The latter presents the forms, the stereoscopic colouring the distribution of the forms in a vertical direction or as regards the elevation above sea-level. What strikes one, on looking into the stereoscope, as specially novel—the immediate visuality of three-dimensional space—is similarly effected by exact chromatostereoscopy used in conjunction with the traditional hatched or tinted shade-picture of our land-maps. The geographical forms are presented as distributed in geographical space, and the maps are developed into three-dimensional pictures. With the precise formulation of the above theory, the terms "Schattenplastik" and "Farbenplastik" have been adopted, as watchwords of the latest phase of cartography, not only in Vienna, but in Austria-Hungary, Germany, and Switzerland. As in the case of every achievement which has attained precise scientific determination, chromatostereoscopic cartography can look back on a long preparatory stage of intuitive, not reflective, endeavour, undirected by any conscious groping after natural laws. The culmination of this stage is to be found in modern Swiss cartography, which thus arrived at a partial application of determinate colour-tones somewhat earlier than the theory of a chromatostereoscopic representation was formulated at Vienna; and it is of interest to observe that it was under the stimulus of these artistic maps (though *subsequently* to the formulation of the colour-code by the Vienna school) that Brückner was led to his new theory of chromatostereoscopic vision. To appreciate the new advance in cartography, we way compare the Swiss maps with the official "Höhenschichten-Karte von Bayern," on the scale of 1:250,000 (Bl. 7, 8, 9). This is the first official large-scale map which has been executed by a combination of "Schattenplastik" and "Farbenplastik," using the Vienna scheme of colouring. In this map alone is the relief visibly presented in its actual form. In this way the third dimension, that of depth or height, is presented to the eye with equal precision with the other two dimensions.

GENERAL.

The German Geographentag.—As was announced in our last number, the German Geographentag took place at Nürnberg towards the end of May, and, according to the programme of the meeting sent out beforehand, the subjects discussed under the various subdivisions of geography were unusually varied and instructive. Five regular sittings were arranged, and were devoted respectively to (1) Reports on Journeys of Exploration; (2) The History of Geography and the Regional Geography of Northern Bavaria; (3) Geographical Education; (4) Anthropogeography and Historical Geography; (5) Limnology and Potamology. Among the papers put down for discussion the following may be cited as instances of subjects which engage the attention of Continental geographers, beyond the more obvious themes connected with the results of exploration, and so forth. Prof. Oberhummer, of Vienna, spoke on "The Plans of Cities, their development and geographical significance;"* Dr. Gasser, of Darmstadt, on "The Technique of

* This appears, somewhat singularly, under the head of the History of Geography, not, as might have been expected, under Anthropogeography.

Apianus' Map of Bavaria;" Dr. J. Müller, of Nürnberg, on "The Nürnberg Reichswald, its surface features and economic development from the thirteenth to the sixteenth century." Among the educational papers, one by Dr. Max Eckert on "Scientific Cartography as a University Subject," and another by Dr. E. Blank on "The Importance of Geological Maps in relation to Agriculture, and their employment in Schools," may be mentioned. Finally, among papers of the fourth group, we find dissertations on the "Climatic Conditions at the opening of the Neolithic Period" (by Prof. W. Götz), and on "The Geography of the temporary Settlements of the Alps" (by Prof. R. Sieger).

CORRESPONDENCE.

The Zimbabwe Temple, and the Discovery of Nanking China, etc.

On my return from Great Zimbabwe just recently, my attention was called to a statement made by Prof. J. L. Myres in his review in the *Journal* of Prof. MacIver's Mediæval Rhodesia,' in which he says I might have found the Nanking china "in the cement mass [under the hut] which stands upon that floor."

Probably Prof. Myres' conjecture may rest on a statement made by Prof. MacIver: "Mr. Hall states that he found in enclosure 15, and therefore necessarily within the same cement which I dug (for its foundations can be traced even now, and occupy the entire enclosure), mediæval Arabic glass and Nanking china;" and further on, "The date of the elliptical temple, then, is not earlier than the fourteenth or fifteenth century."

Briefly the facts are these: (1) Almost three years before Prof. MacIver visited Zimbabwe I found small pieces of Nanking china and Arabic glass at the east end of No. 15 enclosure. These were found almost at the top of a layer (about 3 feet deep) of old Kafir *débris* of the usual midden type, at about 1 foot or 18 inches on the east side, and 2 feet above the top of the opening of the drain which passes right through the north divisional wall of this enclosure, the drain being slightly above the foundations of the wall. The point where I made the "find" is at least 8 or 9 feet from the nearest point of the cement (not a cement, but a *daga* of veld soil clay) foundation on which the hut stood, which *daga* foundation has well-defined sides, the hut and the foundation having been, as photographs show, partially ruined, not by any spade-work, but by a large tree growing out of the clay foundation.

Two years before Prof. MacIver's visit, I had published the fullest particulars as to the exact location of the "find," and in my 'Great Zimbabwe,' I showed the spot in a section of the enclosure (p. 103).

This 3-feet depth of Kafir *débris* contained no soil, or cement, or clay work, but consisted entirely of wood ashes, charred wood, decayed ivory, ox, buck, and bird bones split open Kafir fashion for marrow, and a mass of broken pottery. The trench I originally made was but a small one, and was directly up against the face of the wall, and it was only just large enough to reveal the opening of the drain and 2 or 3 feet on either side of it. This trench was left open for almost 18 months, and during that time it was inspected by many visitors, who were all satisfied that the glass and china could not have got into that position until long after the drain had been blocked up and buried for 3 feet at least in Kafir *débris*, which blocking up and burial had for an exceedingly long time rendered the drain altogether useless. I was led to make my trench in that position because I had found the other opening of the drain on the opposite side of the wall.

(2) The clay mass on which the hut stood did not extend to within at least 8 feet of the drain. It most certainly did not "occupy the entire enclosure." An examination of the face of the walls shows, particularly in their courses and joints, and in their ash *débris* stainings and discolorations, that this was not the case. But supposing it had done so—and there are overwhelming evidences still existing that such was not the case—what object could the two drains through the walls have possibly served, for they are still 4 or 5 feet below the level of the present top of the clay structure? The drains were intended to drain the floor of the enclosure, which, according to Prof. MacIver, was originally filled in with clay to a height of some feet above the drains, and this clay-work occupied the entire enclosure! Had it done so, as he suggests, the drains would have been buried to a depth of 3 or 4 feet in clay.

(3) But right under the centre of the clay structure I obtained, and Prof. Doncaster and several other visitors also obtained, in Prof. MacIver's own trench which he cut through the cement structure, without finding either glass or china, ox and buck teeth and pieces of wood, which it would be most preposterous to suggest as being of the age of the main walls of the temple.

Prof. MacIver but substantiates my case, which was stated over three years before his visit, that the clay mass and the hut upon it are of far more recent date than the erection of the main walls of the temple. The hut was obviously built by later occupiers. In my forthcoming 'Ancient and Mediæval Rhodesia,' I show this to be the case.

One other matter as to the discovery of Nanking china at the temple can be explained. It was reported two years ago that Nanking china had been found by Prof. MacIver *under* the foundations of the main walls of the temple. This, from examinations made of the foundations of the main walls of the temple, is, of course, impossible. But a piece of china was found by Prof. MacIver in No. 5 enclosure at 18 inches below the level of the foundations of the south main wall, but at 37 feet north-north-east (practically at right angles from the wall), and in soil which had been deeply double-trenched during 1892-4 by prospectors for relics and gold, whose handiwork at this spot I had described in 'Great Zimbabwe' two years before Prof. MacIver's visit there. These vandals in their illegal quest had broken up the original floors and all structures both of stone and cement, and had hopelessly mixed soils, deposits, and *débris*. It was in this disturbed soil the piece of Nanking china was found, and at a still lower depth I had already stated in 'Great Zimbabwe' that a soda-water bottle, the brown glass and wire-netting of a cognac bottle, a clay pipe, and an umbrella-frame, were also found. Nanking china discovered under these conditions can provide no possible "valid chronological data" to determine the time when the main walls of the temple were erected. R. N. HALL.

Kenilworth, Cape Town, April 8, 1907.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1906–1907.

RESEARCH DEPARTMENT.

April 19, 1907.—Major C. F. CLOSE, C.M.G., R.E., in the Chair.

The paper read was:—

"The Origin and Influence of the Chief Physical Features of Northumberland and Durham." By David Woolacott, D.SC., F.G.S.

Eleventh Meeting, April 29, 1907.—The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS.—*Captain H. S. Anderson, R.A.M.C.; Gustave Antoine; John Alfred Austin; Oliver Bainbridge; Professor Henry Boazman; William Clarke; Captain David C. E. Ffrench Comyn; Captain W. F. Savery Edwards, D.S.O.; S. C. Gilmour; Captain Alexander Ronald Kirkpatrick, R.G.A.; R. H. Hayne; William Helme; Captain Philip Temple Maxted (3rd East Yorkshire Regt.); B. B. Mukerjea; Frederick Palmer; John James Warbrick; William Weddell.*

The paper read was:—

"Polar Problems." By H. E. Dr. Fridtjof Nansen, G.C.V.O.

Twelfth Meeting, May 13, 1907. The Right Hon. Sir GEORGE T. GOLDIE, K.C.M.G., D.C.L., LL.D., F.R.S., President, in the Chair.

ELECTIONS.—*Robert John Barrett; Major Archibald Crawford, R.G.A.; T. Newman Darling; Joseph Landor Eastland; August Ferber; Percy Edward Lovell Gethin; Frank Grove; Major R. N. Harvey, D.S.O., R.E.; Major A. W. Hewetson, R.G.A.; Arthur Howard; John Hughes; G. E. Leachman, Royal Sussex Regt.; J. Philip Liervogel, F.R.C.S.I., L.R.C.P.; Duncan Paul Livingstone; Henry Colbeck Michell; Colonel Richard E. R. Morse, R.A.M.C.; Alfred Norton, D.S.O.; Rev. W. M. Probert; David Ricardo; John Shepherd Sawrey; T. R. Shields; Fullerton Leonard Waldo; Arthur Henry Whitcher.*

The paper read was:—

"An Expedition from the Niger to the Nile." By Lieut. Boyd Alexander.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. (Mém.) = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. (mét.) = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Col. = Colonies.	R. = Royal.
Com. = Commerce.	Rev. (Riv.) = Review, Revue, Rivista.
C.R. = Comptes Rendus.	S. = Society, Société, Selskab.
E. = Erdkunde.	Sc. = Science(s).
G. = Geography, Géographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	Ts. = Tijdschrift, Tidskrift.
Iz. = Izvestiya.	V. = Verein.
J. = Journal.	Verh. = Verhandlungen.
Jb. = Jahrbuch.	W. = Wissenschaft, and compounds.
k.k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic. **Cori.**

Ein österreichisches Forschungsschiff. Projekt eines solchen für die Zwecke der ozeanographischen und biologischen Erforschung der Adria. Von Prof. Carl J. Cori. Wien, etc.: W. Braumüller, 1906. Size 10 × 6½, pp. 26. *Map and Illustrations. Price 9d.*

Written with a view to stimulating interest in the provision of a vessel, to be specially used for the researches undertaken by the "Verein zur Förderung der naturwissenschaftlichen Erforschung der Adria."

Alps. *M.K.K.G. Ges. Wien* 49 (1906): 465–492. **Hoffer.**

Unterirdisch entwässererte Gebiete in den nördlichen Kalkalpen. Von Dr. Max Hoffer. *With Sketch-maps.*

Alps—Simplon. *M.K.K.G. Ges. Wien* 49 (1906): 493–503. ———

"De Mont Simplono" (Historisches vom Simplonwege). Von D-f.

Austria—Alps—Lakes. *Petermanns M.* 52 (1906): 252–258. **Endrös.**

Seichesbeobachtungen an den grösseren Seen des Salzkammergutes. Von Dr. Anton Endrös.

Austria—Bohemia. *M.K.K.G. Ges. Wien,* 49 (1906): 436–439. **Daneš.**

Geomorphologische Studien in den Tertiärbecken Südböhmens. (Ein vorläufiger Bericht.) Von Dr. Jiři V. Daneš.

Austria—Carinthia. *M.K.K.G. Ges. Wien* 49 (1906): 417–435. **Heritsch.**

Glaziale Studien im Vellachtale. Von Dr. Franz Heritsch. *With Sketch-map.*

Austria—Karst. *Abrégé B.S. Hongroise G.* 34 (1906): 134–146. **Daneš.**

Ein Beitrag zur Kenntnis des Karstphänomens. Von Dr. Ivić V. Daneš. (Földrajzi Közlemények 34 (1906): 305–313. *With Diagrams.*)

Noticed in the Monthly Record (April, p. 455).

Baltic. *Conseil Perm. Explor. Mer., Rapports, etc.* 5 (1906): pp. 274. ———

Bericht über die Tätigkeit der Kommission C2 [Geschäfts-führer Dr. C. G. Joh. Petersen] in den Periode Februar 1903–März 1906. *With Charts and Illustrations.*

Belgium—Hainaut. **Hocquet.**

Tournai et le Tournaisis au XVI[e] siècle au point de vue politique et social. Par Adolphe Hocquet. (*Mém. A.R. Belgique* 1 (1906): Fasc. 2, pp. 418.) *With Map.*

France—Haute-Savoie. *B.S.G. Lille* 46 (1906): 285–297. **Douxami.**

Le désert de Platé et les montagnes entre l'Arve et le Giffre (Haute-Savoie). Par H. Douxami. *With Illustrations.*

France—Pyrenees. *B.S.G. Com. Paris* 28 (1906): 653–659. **Descombes.**

Études d'economie pastorale dans les Pyrénées. Par Paul Descombes.

Deals with the French Pyrenean departments.

Germany—Cities. *G. Anzeiger* 7 (1906): 241–242. **Tronnier.**

Die Grossstadtferne Deutschlands in den Jahren 1871 and 1905. Von Rich. Tronnier. *With Maps.*

Germany—Friesland. **Bielefeld.**

Die Geest Ostfrieslands. Geologische und geographische Studien zur ostfriesischen Landeskunde und zur Entwickelungsgeschichte des Emsstromsystems. Von Dr. Rudolf Bielefeld. (*Forschungen zur deuts. Lands- und Volksk.* 16 (1906): 287–460.) *With Maps and Illustrations.*

Germany—Industries. *Petermanns M.* 52 (1906): 192–204. **Dan.**

Geographische Verbreitung der Berufsgruppe des Deutschen Reiches: Chemische Industrie in Jahre 1895. Von Dr. Walter Dan. *With Map.*

Germany—Prussia—Meteorology. *Meteorologische Z.* 23 (1906): 444–450. **Schubert.**

Wald und Niederschlag in Westpreussen und Posen und die Beeinflussung der Regen- und Schneemessung durch den Wind. Bericht der meteorologischen Abteilung des forstlichen Versuchswesens in Preussen. Von J. Schubert.

Holland—Geology. *K.A.W. Amsterdam, P. Sect. Sc.* 8 (1905): 427–436. **Dubois.**

The geographical and geological signification of the Hondsrug, and the examination of the erratics in the Northern Diluvium of Holland. By Prof. Eug. Dubois.

Holland—Geology. *K.A.W. Amsterdam, P. Sect. Sc.* 8 (1905): 96–104. **Jonker.**

Some observations on the geological structure and origin of the Hondsrug. By Dr. H. G. Jonker.

United Kingdom—Lake District. **Rastall and Smith.**
Geol. Mag., Dec. V., 3 (1906): 406–412.
Tarns on the Haystacks Mountain, Buttermere, Cumberland. By R. H. Rastall and Bernard Smith. *With Map and Illustrations.*
Noticed in the Monthly Record (March, p. 343).

United Kingdom—Scotland. *Ann. de G.* **15** (1906): 237–248. **Hardy**
La végétation des Highlands d'Écosse. Par Marcel Hardy. *With Map.*

United Kingdom—Scotland. **Lewis.**
The Plant Remains in the Scottish Peat Mosses. Part II. The Scottish Highlands. By Francis J. Lewis. (From the *Transactions of the Royal Society of Edinburgh*, vol. **45**, part II. (No. 13).) Edinburgh, 1906. Size $12\frac{1}{4} \times 9\frac{1}{2}$, pp. [26]. *Plates. Presented by the Author.*

United Kingdom—Staffordshire. **Gibson and Wedd.**
Memoirs of the Geological Survey: England and Wales. Explanation of Sheet 193. The Geology of the Country around Stoke-upon-Trent. By Walcot Gibson and C. B. Wedd, with Notes by George Barrow. Second Edition. London, 1905. Size $9\frac{1}{2} \times 6$, pp. viii. and 86. *Map and Diagrams. Price* 1s. 6d. *Presented by the Geological Survey.*

United Kingdom—Suffolk. **Mill.**
The Rainfall of Suffolk. By Dr. Hugh Robert Mill. (Reprinted from the Geological Survey Memoir on 'The Water-Supply of Suffolk,' 1906.) Size $9\frac{1}{2} \times 6$, pp. [6]. *Map. Presented by the Author.*

United Kingdom—Yorkshire. **Mill.**
The Rainfall of the East Riding of Yorkshire. By Dr. Hugh Robert Mill. (Reprinted from the Geological Survey Memoir on 'The Water-Supply of the East Riding of Yorkshire.') [London, 1906.] Size 10×6, pp. [10]. *Map. Presented by the Author.*

United Kingdom—Yorkshire. *J. Linnean S., Botany* **37** (1906): 333–406. **Woodhead.**
Ecology of Woodland Plants in the Neighbourhood of Huddersfield. By T. W. Woodhead. *With Map and Illustrations.*

ASIA.

Central Asia—Tian-Shan. *Abrégé B.S. Hongroise G.* **34** (1906): 151–165. **Prinz.**
Reiseskizzen aus Centralasien. Von Dr. Julius Prinz. (*Földrajzi Közlemények* **34** (1906): 371–379.) *With Diagrams.*

Ceylon. **Dunstan.**
Colonial Reports, Miscellaneous, No. 37. Ceylon. Report on the Results of the Mineral Survey in 1904–5. By Prof. W. R. Dunstan. London, 1906. Size $9\frac{1}{2} \times 6$, pp. 46. *Price* $2\frac{1}{2}$*d.*

China—Kwang-chou-wan. *Rev. Française* **31** (1906): 529–536. **Barré.**
Le territoire français de Kouang-tchéou. Par Paul Barré.

China—Railway. *B. American G.S.* **38** (1906): 554–556. ——
The Peking-Hankow Railway. *With Map.*

China—Shanghai. **Moidrey.**
Sicawei Observatory. Notes on the climate of Shanghai, 1873–1902. By J. de Moidrey. Shanghai, 1904. Size $7\frac{1}{2} \times 5$, pp. 40. *Chart and Diagrams. Price* 2s. 6d.
Supplies useful information, not easily to be obtained elsewhere, on the basis of observations at the Jesuit observatory.

China Sea. ——
The China Sea Directory. Vol. **1.** Containing Directions for the approaches to the China Sea, by Malacca, Singapore, Sunda, Banka, Gaspar, Carimata, Rhio, Berhala, and Durian Straits. 5th edit. London, 1906. Size $9\frac{1}{2} \times 6$, pp. xxvi. and 734. *Index-chart.*

Chinese Empire—Turkestan. *T'oung Pao* **7** (1906): 469–480. **Stein.**
Hsüan-Tsang's Notice of P'i-mo and Marco Polo's Pein. By Dr. M. Aurel Stein.

Dutch East Indies. **Heger.**
Bericht über eine Studienreise nach Niederländisch-Indien (30 Dezember, 1903–29, September, 1904). Von Franz Heger. (Separat-Abdruck aus dem xxi. Band der

Annalen des k.k. Naturhistorischen Hofmuseums.) Wien, 1906. Size 11 × 7, pp. 40.

The principal attention appears to have been devoted to ethnology, but the paper includes notes on the geography and geology of the places visited.

Dutch East Indies—Java—Rainfall. **Niermeyer.**

Ts. K. Nederlandsch Aardrijksk. Genoots. 23 (1906): 1182–1185.

De regenval aan de vlakke kusten van Java. Door J. F. Niermeyer.

Dutch East Indies—Moluccas. **McClymont.**

The First Expedition of the Portuguese to Banda, and the Events Antecedent thereto. Compiled . . . by James Roxburgh McClymont. Hobart, 1905. Size 10 × 6, pp. 10. *Presented by the Author.*

Eastern Asia—Historical. *T'oung Pao* 7 (1906): 437–468. **Gerbillon and Cordier.**

Cinq lettres inédites du Père Gerbillon, S.J., Missionaire français à Pe-king (XVII[e] et XVIII[e] siècles). Publiées par Henri Cordier.

French Indo-China. ———

Publications de la Société des Études Indo-Chinoises. Géographie physique, économique et historique de la Cochinchine; 7[e]–9[e] fascicules. Monographies des provinces de Bên-tré, Sa-déc, et Tra-vinh. Saigon, 1903. Size 10 × 6½, pp. (fasc. 7) 66; (fasc. 8) 32; and (fasc. 9) 44. *Maps. Price 3s. each.*

India. **Reynolds-Ball.**

The Tourist's India. By Eustace Reynolds-Ball. London: Swan, Sonnenschein & Co., 1907. Size 8 × 5, pp. xii. and 364. *Map and Illustrations. Price* 10*s.* 6*d.* *Two copies, presented by the Author and Publishers.*

India—Burma. *Jahresb. G.-Ethnogr. Ges., Zurich,* 1905–06 (1906): 41–154. **Wehrli.**

Zur Wirtschafts-Geographie von Ober Burma und den nördlichen Shan-Staaten. Von Dr. Hans J. Wehrli. *With Maps and Illustrations.*

India—Minerals. *Records Geol. Surv. India* 34 (1906): 45–78. **La Touche.**

The Mineral Production of India during 1905. By T. D. La Touche.

India—Survey. ———

Administration Report of the Marine Survey of India, 1905–06. Bombay, 1906. Size 13 × 8½, pp. 14.

Surveys were in progress during the year in Aden harbour and in the Andamans.

India—Survey. ———

General Report on the operations of the Survey of India . . . during 1904–05, prepared under the direction of Colonel F. B. Longe. Calcutta, 1906. Size 13 × 8½, pp. iv., 68, and iv. *Maps and Portraits.*

Includes a summary of the recommendations of the Committee on Indian Surveys.

AFRICA.

Abyssinia. *M. k.k. G. Ges., Wien* 49 (1906): 377–416. **Mylius.**

Reise nach Kaffa und Da'uro. Von Alphons Freiherrn von Mylius.

Some account of this expedition was given in the *Journal* for May, 1906 (p. 503).

Abyssinia—Treaty. ———

Treaty Series, No. 1, 1907. Agreement between the United Kingdom, France, and Italy respecting Abyssinia. Signed at London, December 13, 1906. London, 1907. Size 9½ × 6, pp. 8. *Price* 1*d.*

See note in the February number (p. 225).

Africa—Transport. *Z. Kolonialpolitik, etc.* 8 (1906): 902–924. **Kurchhoff.**

Die Lastenbeförderungsmittel in Africa. Von D. Kürchhoff.

Central Africa—Tanganyika. *T. Zoological S.* 17 (1906): 537–600. **Boulenger.**

Fourth Contribution to the Ichthyology of Lake Tanganyika.—Report on the Collection of Fishes made by Dr. W. A. Cunnington during the Third Tanganyika Expedition, 1904–1905. By G. A. Boulenger. *With Plates and Sketch-map.*

Egypt—Surveys. **Lyons**

A Report on the work of the Survey Department in 1905. By Captain H. G. Lyons. Cairo, 1906. Size 11 × 8, pp. 76. *Maps and Illustrations.*

Eritrea—Climate. *Riv. Col.* **2** (1906): 133–169. **Tancredi.**
Appunti di climatologia eritrea. Di A. M. Tancredi.
Noticed in the Monthly Record (*ante*, p. 675).

French Congo—Railway. *La G., B.S.G. Paris* **14** (1906): 405–410. **Cambier.**
Mission technique au Congo français. Le chemin de fer projeté. Par le capitaine L. Cambier. *With Sketch-map.*
See note in the March number (p. 347).

German East Africa. *Deutsches Kolonialblatt* **17** (1906): 747–751. **Jaeger.**
Bericht des Dr. Fritz Jaeger an den Vorsitzenden der Landeskundlichen Kommission über eine Reise nach dem Kibo. *With Illustrations.*
See note in the Monthly Record (April, p. 457).

Italian Somaliland—Mogdishu. *Riv. Col.* **2** (1906): 202–212. **Rossetti.**
Tre note sulla città di Mogadiscio. Di Carlo Rossetti. *Also separate copy, presented by the Author.*
Historical notes on the town.

Morocco. **Leclercq.**
Le Maroc. Par Jules Leclercq. (Extrait de la *Revue Générale*, mars, 1906.) Bruxelles, 1906. Size 9½ × 6, pp. 18. *Presented by the Author.*

Morocco—Sebu. *La G.* **14** (1906): 181–184. **Pobeguin.**
Reconnaissance du Sebou par la mission Dyé. Par E. Pobeguin. *With Map and Illustrations.*
The general results of the Dyé mission were referred to in the February number, p. 226.

South Africa—Kalahari. *B.S.R. Belge G.* **30** (1906): 174–184. **Zels.**
Le Kalahari au pointe de vue de la géographie humaine. Par L. Zels. *With Maps.*

Transvaal—Irrigation. *Minutes of P., I. Civil Engineers* **165** (1906): 265–281. **Collins.**
Irrigation in the Transvaal. By Michael Richard Collins.

Tristan da Cunha. ——
Tristan da Cunha. Further Correspondence relating to the Island of Tristan da Cunha. London: Wyman & Sons, 1906. Size 13 × 8½, pp. iv. and 64. *Map and Illustration. Price* 10*d.*
Noticed in the Monthly Record (February, p. 227).

Tunis—Historical. *B. de G. hist. et descriptive* **20** (1905): 311–330. **Demontès.**
La mission du Commandant Huder à Tunis (1831). Par Victor Demontès.

West Africa—Ethnology. *B. de G. Hist. et Descriptive* **20** (1905): 357–412. **Avelot.**
Recherches sur l'histoire des migrations dans le bassin de l'Ogôoué et la région littorale adjacente. Par R. Avelot. *With Maps. Also separate copy, presented by the Author.*

West Africa—Historical. *Z. Kolonialpolitik, etc.* **8** (1906): 767–780. **Götz.**
Die brandenburgish-preussische Kolonisation in Guinea unter Friedrich Wilhelm, dem Grossen Kurfürsten. Von Adolf Götz.

West Africa—Waterway. *Deutsche Kolonialzeitung* **23** (1906): 304–305. **[Faure.]**
Der Wasserweg von Meerbusen von Guinea zum Tschadsee. *With Sketch-map.*
On Captain Faure's expedition.

NORTH AMERICA.

Alaska. *U.S. Geol. Surv., B. No.* 284 (1906): pp. 170. **Brooks and others.**
Report on Progress of Investigations of Mineral Resources of Alaska in 1905. By Alfred H. Brooks and others. *With Maps and Illustrations.*

Canada—British Columbia. **Wheeler.**
The Selkirk Range, British Columbia. By A. O. Wheeler. Vol. 2. *Case of Maps.* Size 9½ × 6½. *Presented by the Author.*
Vol. 1 was noticed in the November number (p. 501).

Canada—Labrador. *B. American G.S.* **38** (1906): 529–539. **Hubbard.**
Labrador, from Lake Melville to Ungava Bay. By Mrs. Leonidas Hubbard. *With Map and Illustrations.*
See Monthly Record, March, p. 349.

United States—California. *J. of G.* **5** (1906): 289-301. **Carey.**
The great fault of California and the San Francisco earthquake, April 18, 1906. By Everett P. Carey. *With Illustrations.*

United States—California. **Davidson**
P. Amer. Philos. S. **45** (1906): 164-165, 178-182.
The San Francisco Earthquake of April, 1906. By Prof. G. Davidson.
Points of Interest involved in the San Francisco Earthquake. By the same.

United States—Colorado. *Popular Sc. Monthly* **69** (1906): 417-424. **Crook.**
The making of the Grand Cañon of the Colorado. By Prof. A. R. Crook. *With Illustrations and Section.*

United States—Geology. **Emmons and Eckel.**
B.U.S. Geol. Surv., No. 285 (1906): pp. 506.
Contributions to Economic Geology, 1905. S. F. Emmons and E. C. Eckel, Geologists in charge. *With Maps and Sections.*

United States—Immigration. **[Lindsay.]**
Report on Immigration into the United States. (Diplomatic and Consular Reports, Miscellaneous, No. 655.) London, 1906. Size 9½ × 6, pp. 30. *Price 2d.*

United States—Michigan. **Jefferson.**
Material for Geography of Michigan. By Mark S. W. Jefferson. Ypsilanti, 1906. Size 10 × 7, pp. 90. *Maps and Illustrations.*

United States—Montana and Wyoming. **Darton.**
U.S. Geol. Surv., Prof. Paper, No. 51 (1906): pp. 130.
Geology of the Bighorn Mountains. By N. H. Darton. *With Maps, Plates, and Sections.*

United States—Norwegians. *Norske G.S. Aarbog* **17** (1905-6): 17-64. **Kiaer.**
Den norsk-amerikanske Befolknings geografiske Udbredelse i de Forenede Stater. Af A. N. Kiaer. *With Sketch-maps.*

United States—Vermont. *P. Boston S. Natural Hist.* **33** (1906): 9-42. **Fisher.**
Terraces of the West River, Brattleboro, Vermont. By E. F. Fisher. *With Maps, Sections, and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Argentine—Irrigation. **Wauters.**
An. S. Cient. Argentina **57** (1904): 49-97, 113-161, 241-288, 305-310.
El dique de embalse del Cadillal. Por Carlos Wauters. *With Maps, Plans, and Diagrams.*

Bolivia. **Zalles.**
Quinientas Leguas a traves de Bolivia. Relacion del viaje de reconocimiento practicado para establecer un sistema de ferrocarriles en Bolivia, 1904-1905. Por Jorje E. Zalles. La Paz, 1906. Size 9 × 6, pp. 176. *Map and Illustrations.*

Bolivia—Ethnology. **Quevedo and Armentia.**
An. S. Cient. Argentina **52** (1901): 145-160, 288-306; **53** (1902); 49-65, 150-157, 234-241, 293-297; **54** (1902): 49-60, 144-150, 181-201, 272-282.
Los Indios Mosetenes y su lengua. Introducción, por Samuel A. Lafone Quevedo. Noticias generales y vocabularios, por el P. Fr. Nicolas Armentia.

British Guiana. *B. American G.S.* **38** (1906): 539-553. **Heilprin.**
Impressions of a Naturalist in British Guiana. By Prof. Angelo Heilprin. *With Illustrations.*

Chile—Seismology. *B.S.G. Italiana* **8** (1907): 30-37. **Baratta.**
Sulla distribuzione topografica dei terremoti nel Chili. Del Dott. M. Baratta. *With Map.*
Noticed in the Monthly Record (April, p. 462).

Chile—Valparaiso. *Tour du Monde* **13** (1907): 1-12. **Bourdon.**
La catastrophe de Valparaiso. Par Henri Bourdon. *With Illustrations.*

Costa Rica. *Tour du Monde* **12** (1906): 529-540. **Saillard.**
En traversant la République de Costa-Rica. Par M. Saillard.

West Indies—Cuba. *Nat. G. Mag.* **17** (1906): 535-568. ———
Cuba—the Pearl of the Antilles. *With Map and Illustrations.*

West Indies—Porto Rico. *Monthly Weather Rev.* 34 (1906): 315–324. **Alexander.**
Climatology of Porto Rico from 1867 to 1905, inclusive. By William H. Alexander.

West Indies, etc. *Tour du Monde* 12 (1906): 541–576. **Dufau.**
Voyage au pays du cacao et du sucre de canne. Une mission à la Barbade, à la Guyane anglaise et à la Trinidad. Par Th. Dufau. *With Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Fishes. **Stead.**
Fishes of Australia: a popular and systematic guide to the study of the wealth within our waters. By David G. Stead. Sydney, 1906. Size 8½ × 5½, pp. xii. and 278. *Illustrations. Price 5s. Presented by the Board of Fisheries for New South Wales.*

New Hebrides. ——
France. No. 1 (1906). Convention between the United Kingdom and France, confirming the Protocol signed at London on February 27, 1906, respecting the New Hebrides. London, 1906. Size 13 × 8½, pp. 32. *Price 3½d.*
See note in the Monthly Record (February, p. 230).

Pacific Islands—Nomenclature. *G. Anzeiger* 7 (1906): 247–249. **Arldt.**
Die Namen der ozeanischen Inselgruppen. Von Dr. Th. Arldt.

South Australia. *P.R.G.S. Australasia, S. Australian Br.* 8 (1904–06): 48–54. **Gill.**
Who discovered Lake Alexandrina? By Thomas Gill.
Shows, from records preserved at Sydney, that Lake Alexandrina had been discovered from the south, possibly by Captain Forbes, of the sealer *Prince of Denmark*, before being reached by Sturt.

South Australia—Historical. **Horrocks.**
P.R.G.S. Australasia, S. Australian Br. 8 (1904–06): 36–47.
John Ainsworth Horrocks' Journal. *With Map and Illustrations.*
Horrocks emigrated to South Australia in 1837, and gave promise of a useful career as an explorer, but died from the effects of a gun accident in 1846, during the expedition described in the journal here printed.

South Australia—Kangaroo Island. **Smyth.**
P.R.G.S. Australasia, S. Australian Br. 8 (1904–06): 55–58.
Frenchman's (Baudin's) Rock, Kangaroo Island. By C. E. Owen Smyth. *With Illustration.*

Western Australia—Pearl Fishery. **Sowden.**
P.R.G.S. Australasia, S. Australian Br. 8 (1904–06): 21–[illegible]
On Pearl-fishing in North-West Australia. By W. J. Sowden.

POLAR REGIONS.

Antarctic—Ice. *Geological Mag.*, Dec. V. 3 (1906): [illegible] **Ferrar.**
The Antarctic Ice-cap. By H. T. Ferrar. *With Illustrations.*
A reply to Mr. Schwarz's note (cf. *Journal*, vol. [illegible], p. [illegible]).

Antarctic—Marine Flora. **Skottsberg.**
Observations on the vegetation of the Antarctic Sea. By Carl Skottsberg. [illegible] "Botaniska Studier" [illegible] F. R. Kjellman. Upsala, 1906. Size [illegible] *Illustrations. Presented by the Author.*

Antarctic—South Georgia. **Lönnberg.**
Contributions to the Fauna of South Georgia. I. Taxonomic and Biological Notes on Vertebrates. By Einar Lönnberg. K. Svenska Vetenskapsakademiens Handlingar, Band 40, No. 5. Upsala, 1906. Size [illegible], pp. 104. *Illustrations.*

Arctic—Swedish Expedition. **Hamberg.**
[illegible] Arktiska [illegible] A. G. Nathorst [illegible] Axel Hamberg. K. Svenska Vetenskapsakademiens Handlingar, Band [illegible], No. [illegible]. Upsala, 1906. Size [illegible], pp. 58. [illegible]

Arctic Ocean. **Hansen.**
[illegible] Arctic [illegible] Arctic Seas [illegible]

Northern Seas. By Fridtjof Nansen. Christiania, 1906. Size 10½ × 7, pp. 146. *Charts and Sections. Presented by the Author.*

Polar Regions. *Monthly Rev.* **25** (1906): 33–53. **Arctowski.**
Polar Problems and the International Organisation for their solution. By Henryk Arctowski.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Cartography. **Frith.**
The Topographical Section of the General Staff: with an Account of the Geographical Services of the Austrian, French, German, and Russian, Armies. By Captain G. R. Frith, Chatham, 1906. Size 7 × 5½, pp. 64.

Geodesy. *M.V.E. Dresden* (1906): 12–39. **Pattenhausen.**
Der Anteil der Vereinigten Staaten an der Erforschung der Erdgestalt durch Gradmessungen. Von B. Pattenhausen. *With Map.*

Longitudes. *Petermanns M.* **52** (1906): 261-262. **Hammer.**
Geographische Längen durch die drahtlose Telegraphie. Von Prof. Dr. E. Hammer.

On a recent experiment conducted by Herr Albrecht of the Potsdam Geodetic Institute for the testing of longitude determination by wireless telegraphy.

Surveying. **[Clancey.]**
Survey Manual for Land Records Officers. [By J. C. Clancey.] Rangoon, 1906. Size 10 × 7, pp. vi. and 42. *Plans and Illustrations. Price 9d. Presented by the Author.*

Surveying—Tables. **Burrard.**
Auxiliary Tables to facilitate the calculations of the Survey of India. Fourth Edition. Revised and extended . . . By Lieut.-Colonel S. G. Burrard. Dehra Dun, 1906. Size 11 × 8½, pp. 104 and 176. *Charts. Presented by the Surveyor-General of India.*

Time. *Publs. U.S. Naval Observatory,* 2 Ser. **4** (1906): Appendix iv., pp. 28. **Hayden.**
The present status of the use of Standard Time. By Lieut. Edward Everett Hayden.

A useful table facilitates the conversion of the standard time of one country into that of any other.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. *Monthly Weather Rev.* **34** (1906): 201-205. **Ball.**
Present day climates in their time relation. By Frank Morris Ball.

The writer shows that the idea of present-day changes of climate are hardly substantiated by facts.

Climatology. *K.A.W. Amsterdam, P. Sect. Sc.* **8** (1905): 155-165. **Easton.**
Oscillations of the solar activity and the climate. (Second communication.) By Dr. C. Easton. *With Diagrams.*

Climatology. *Popular Sc. Monthly* **69** (1906): 458–470. **Ward.**
Changes of Climate. By Robert De C. Ward.

The author shows that beliefs as to contemporary changes of climate must be received with caution.

Geology—Folding. *J. Geology* **14** (1906): 718–721. **Campbell.**
Rock Folds due to Weathering. By Marius R. Campbell. *With Illustration.*

Geomorphology—Mounds. *J. Geology* **14** (1906): 708-717. **Campbell.**
Natural Mounds. By Marius A. Campbell. *With Illustrations.*

Geomorphology—Natural Bridges. **Früh.**
Ueber Naturbrücken und verwandte Formen, mit spezieller Berücksichtigung der Schweiz. Ein Beitrag zur Landeskunde, von J. Früh. St. Gallen, 1906. Size 8 × 5½, pp. 30. *Maps and Illustrations. Presented by the Author.*

Geophysics. *C.R.A. Sc., Paris* **143** (1906): 710–712. **Jourdy.**
Le substratum archéen du globe et le mécanisme des actions géodynamiques. Note de E. Jourdy.

Glaciers. **Reid and Muret.**
Commission Internationale des Glaciers. Les variations périodiques des glaciers. Onzième Rapport, 1905, rédigé par Dr. Harry Fielding Reid et Muret. Berlin, 1906. Size 10 × 7, pp. 22.

Glaciers. **Willcox.**
The viscous *vs.* the granular theory of glacial motion. By Oswin W. Willcox. Long Branch, N.J., 1900. Size 9 × 6, pp. 24. *Presented by the Author.*

Ice. *Iz. Imp. Russian G.S.* **41** (1905): 289-396. ———
Report of the Committee for the study of ground-ice on the work done in 1904. *With Map.* [In Russian.]

Oceanography—North Sea Fisheries. ———
North Sea Fishery Investigations. Report of the British Delegates attending the Meeting of the International Council for the Exploration of the Sea, at Amsterdam in 1906, and Reports relating thereto. London, 1906. Size 13 × 8½, pp. 44. *Price* 4½*d.*

Oceanography—Sea-water. **Ruppin.**
Bestimmung der elektrischen Leitfähigkeit des Meereswassers. Von Dr. E. Ruppin. Umkippthermometer als Tiefenmesser. (By the same.) Kiel, 1906. Size 12½ × 10½, pp. [8]. *Presented by the Deutschen Wissenschaftlichen Kommission für die Internationale Meeresforschung.*

Oceanography—Temperature. **Van der Stok.**
Ueber Oberflächentemperaturen des Meerwassers unweit der Niederländischen Küste. Von Dr. J. P. Van de Stok. (Koninklijk Nederlandsch Meteorologisch Instituut, No. 102. Mededeelingen en Verhandelingen, No. 4.) Utrecht, 1906. Size 10 × 6½, pp. 25-56. *With Diagram.*

Seismology. *J. College Sc., Tōkyō* **21** (1906): *Article* 1, pp. 20. **Kusakabe.**
Frequency of After-shocks and Space-distribution of Seismic Waves. By S. Kusakabe. *With Map.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *C.R.A. Sc. Paris* **143** (1906): 1186-1188. **Pittard.**
Influence du milieu géographique sur le développement de la taille humaine. Note de Eugène Pittard.

Commercial. **Halle.**
Die Weltwirtschaft: ein Jahr- und Lesebuch, unter Mitwirkung zahlreicher Fachleute herausgegeben von Dr. Ernst von Halle. I. Jahrgang, 1906; III. Teil. Das Ausland. Leipzig, etc.: B. G. Teubner, 1906. Size 11 × 7½, pp. 282. *Price* 5 *marks. Presented by the Publisher.*

Commercial—Ivory. *J.S. Arts* **54** (1906): 1127-1142, 1146-1169, 1174-1183. **Maskell.**
Ivory, in Commerce and in the Arts. By Alfred Maskell. *With Illustrations.*

Historical—Maps. *B.S.G. Italiana* **7** (1906): 1087-1098. **Bruzzo.**
Sopra alcune carte nautiche esistenti nella Biblioteca comunale di Bologna. Del Prof. Giuseppe Bruzzo.

The maps described range from Freducci's atlas of the early part of the sixteenth century to less-known maps of the seventeenth century.

Historical—Map. **Detlefsen.**
Ursprung, Einrichtung und Bedeutung der Erdkarte Agrippas. Von D. Detlefsen. (Quellen und Forschungen zur alten Geschichte und Geographie, Herausgegeben von W. Sieglin. Heft 13.) Berlin: Weidmannsche Buchhandlung, 1906. Size 10 × 6, pp. vi. and 118.

Historical—Map. *Abrégé B.S. Hongroise G.* **34** (1906): 121-129. **Teleki.**
Je ein Monument der Kartographie des xv. und des xvi. Jahrhunderts im Ungarischen Nationalmuseum zu Budapest. Bericht des Gr. Paul Teleki. (Földrajzi Kozlemenyek 34 (1906): 280-287.) *With Facsimiles.*

The documents, which do not seem to have been previously described, are an Atlas of Benincasa of 1474, and a sixteenth-century Portolano embracing the Mediterranean,

etc. The nomenclature of the west coast of Africa in the former is very much fuller than on Benincasa's map of 1466–67, as is shown by a comparative table.

Historical—Toscanelli. *Riv. G. Italiana* 7 (1906): 419–421. **Uzielli.**
I Toscanelli di Dieppo. Nota di Gustavo Uzielli.

BIOGRAPHY.

Ahlenius. *Ymer* (1906): 305–312. **Andersson.**
Karl Ahlenius. Af J. G. Andersson. *With Portrait.*

The late Professor of Geography at Upsala University, one of the best-known exponents of scientific geography in Sweden, was born in 1866.

Krause. **Köhler.**
Der Philosoph Carl Christian Friedrich Krause als Geograph. Von Dr. Arthur Köhler. Leipzig: Dieterich, 1905. Size 9 × 6, pp. 94.

Linneus. *Ymer* (1906): 221–250. **Fehr.**
Linnés Svenska resor. Af Isak Fehr.
On Linneus' journeys in Sweden.

Russell. *J. Geology* **14** (1906): 663–667. **Gilbert.**
Israel Cook Russell, 1852–1906. By G. K. Gilbert. *With Portrait.*

GENERAL.

British Empire. **Smith.**
The British Empire in its true proportions. (Designed and published by Stephen Smith.) Edinburgh, [*n. d.*]. Size 10 × 7½, pp. 4. *Map. Presented by the Author.*

The map combines representations of different parts of the Empire, projected on different planes in such a way as to show them on a common scale in more or less correct relation to each other.

Descriptive. **Leclercq.**
Jules Leclercq. Spectacles d'outre-mer. Paris: A. Lemerre, 1906. Size 7½ × 5, pp. iv. and 226. *Price* 3.50 *fr. Presented by the Author.*

Sonnets inspired by places and scenery with which the author's travels have made him acquainted.

Diseases. ——
Report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1906. London, 1907. Size 13 × 8½, pp. 56. *Price* 5½*d.*

French Colonies. ——
Ministère des Colonies: Office Colonial. Statistiques Coloniales pour les années de 1900 à 1904. Industrie Minière.—[The same], pour l'année 1905. Publiées sous l'administration de Georges Leygues. Melun, 1906. Size 9½ × 6, pp. (1900–04), 238, (1905) 110.

Geography. *Scottish G. Mag.* **23** (1907): 1–13. **Goldie.**
Geographical Ideals. By Sir George Taubman Goldie. *With Portrait.*

Geography. *Ts. K. Nederlandsch Aardrijksk. Genoots.* **23** (1906): 1097–1181. **Kan.**
Nieuwere opvattingen van Aardrijkskunde. Door Prof. Dr. C. M. Kan. *Also ...py, presented by the Author.*

...ies. *G.Z.* **12** (1906): 545–567, 630–641. **Hänsch.**
...e Kolonialreich. Eine politisch-geographische Studie von Bruno Felix

...raphy. **Maguire.**
...igns of Napoleon. By J. Miller Maguire. (Reprinted from the *United* ...zine.) London: Clowes & Sons, 1906. Size 8½ × 5½, pp. 8. *Map.*

...ness. **Longstaff.**
...ickness and its probable causes. By Dr. T. G. Longstaff. London: ...e & Co., 1906. Size 8½ × 5½, pp. 56. *Price* 1*s. Presented by the*

...number, p. 577.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Albania. **Nopcsa.**

Dr. Báro Nopcsa Ferencz. Utazások Éjszak Albaniában [Reisen in Nord-Albanien], 1905–06. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. [1907.] *Presented by Baron Nopcsa.*

A somewhat roughly executed sketch-map of routes in the part of Albania to the north-east and south-east of Scutari, which place is shown on the western limit of the map. A black and white sketch-map is given as an inset, showing the main geological features of the district.

Channel Islands. **Bartholomew.**

Bartholomew's reduced survey maps of the Channel Islands. Edinburgh: John Bartholomew & Co., [1907]. *Price* 2*s. net, mounted on cloth. Presented by the Publishers.*

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from April 1 to 30, 1907.

2 miles to 1 inch.

Large series, printed in colours, folded in cover or flat in sheets, 1, 2. *Price, on paper,* 1*s.* 6*d.*; *mounted on linen,* 2*s.*; *mounted in sections,* 2*s.* 6*d. each.*

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6-inch—County Maps (first revision):—

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England and Wales. **Geological Survey.**

6-inch—Uncoloured. Brecknockshire, 49 N.E., 50 N.E. Glamorgan, 10 N.W., N.E., S.W., S.E., 11 N.E., S.W., 18 N.W., N.E., S.W. 1*s.* 6*d. each.*

(*E. Stanford, London Agent.*)

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: xi. 24, Aulnay; xii. 14, Argentan; xii. 23, La Mothe St. Héray; xii 37, Luz; xvii. 5, Bergues; xix. 8, Le Cateau; xxi. 18, Montbard(est); xxii. 19, Dijon; xxiv. 36, Toulon. Paris: Ministère de l'Intérieur. Service Vicinal, 1906–07. *Price* 0.80 *fr. each sheet.*

These are new editions.

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartogr. Abteilung der Kg. Preuss. Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet 240,

Wittenberge. Berlin: K. Preussische Landesaufnahme, 1906. *Price* 1.50*M. each sheet.*

London. **Hollar.**

London, Westminster, and Southwark, drawn and engraved by Wenceslaus Hollar. Published at Antwerp in 1647. Sheets iv., v., and vi. London: The London Topographical Society, 1906.

There are altogether six sheets of this famous bird's-eye view of London, of which facsimiles of three only are now published, the remaining three being promised next year. Each sheet measures 18¼ × 15¼ inches, and the three at present issued extend from some distance east of the Tower to the Guildhall and Bow Church. When placed side by side, the sheets present a striking panoramic view of London as it appeared a few years before the Great Fire.

London. **University Extension Guild.**

Map of London showing Local Centres for University Extension Teaching from 1876 to 1905. Prepared from Official Data of the University of London. Scale 1 : 63,360 or 1 inch to a stat. mile. London: University Extension Guild, 1907.

Spain. **Gillman.**

The Valley of Almanzora, with portions of the Provinces of Jaen, Granada, Almeira, and Murcia. By Gustave Gillman. Scale 1 : 50,000 or 1·3 inch to a stat. mile. 1907. *Presented by the Author.*

This is a photo-lithographic reproduction, on linen, of a map drawn primarily for the purpose of studying the road communications throughout the district served by the Great Southern of Spain railway, which embraces portions of the provinces of Jaen, Granada, Almeira, and Murcia. The basis of the survey was the centre line of the railway; the geographical positions of Lorca, Aguilas, Baza, and Seron having been fixed by repeated astronomical observations, and these were connected by triangulation with the government triangulation station on the Tetica de Bacares (which was one end of the base used for connecting the Spanish triangulation with the French Survey in Algiers). The result of the triangulation, though only carried out with a 6-inch theodolite, showed it to be so far accurate that the calculated distance between the Tetica de Bacares and Aguilas came within 32 metres of the distance as obtained by the longitude.

The plotting was done by rectangular co-ordinates off the middle latitude, so that there is a slight inaccuracy in the scale at the extreme edges of the map.

The detail has been filled in from various isolated surveys by the author for mining purposes and from advance details of the government surveys of the municipal districts. The course of the Rambla de Nogalte as laid down on this map calls for special attention, as it has been erroneously shown on most maps in the past.

The author proposes to supplement the present map by a contoured one, which is in course of preparation.

Spain. **Méndez.**

Carte des routes d'Espagne. Dediée au Royal Automobile Club d'Espagne avec indications et signes routières de M. le Dr. Wood McMurtry. Dressée par M. José Méndez. Scale 1 : 1,500,000, or 1 inch to 23·6 stat. miles. Madrid: José Méndez.

Spain. **Méndez.**

Collection d'itineraires des routes, pour la visite des provinces et côtes maritimes d'Espagne, composé de 13 cahiers, dédiés au Royal Automobile Club d'Espagne. Scale 1 : 200,000 or 1 inch to 3·1 stat. miles. Madrid: José Méndez, 1907.

ASIA.

Caucasia. **Topographical Section, General Staff.**

Map of Caucasia. Scale 1 : 2,027,520, or 1 inch to 32 stat. miles. Plate 1. London: Topographical Section, General Staff, War Office, 1906. *Presented by the Director of Military Operations.*

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 1 inch to 4 miles. Sheets: 15, parts of districts Rawal Pindi, Jhelum, Shahpur, Attock, and Mianwali (Punjab), and Kohat, Bannu, and Dera Ismail Khan (N.W.F. Province), 1904. 103, parts of districts Azamgarh, Ghazipur, Ballia, Gorakhpur, Benares and Mirzapur (U.P.), and Saran, Muzaffarpur, Darbhanga, Gaya, Patna and Shahabad (Bengal), 1904. 106, parts of districts Sambalpur and Angul (Bengal), Bilaspur (C.P.) and of states Sonpur, Rairakhol, Bamra, Baud and Athmalik (Bengal), Raigarh and Sarangarh (C.P.), 1905. 113,

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Persia. **Herzfeld.**

Routenkarte von Bachdād nach Šīrāz durch Lūristān, Khūristān und Fārs. Nach eigenen Aufnahmen von Ernst Herzfeld. Blatt ii. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1907, Tafel 17. Gotha: Justus Perthes, 1907. *Presented by the Publisher.*

AFRICA.

Africa. **Topographical Section, General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. Sheet 119, Walfisch Bay. London: Topographical Section, General Staff, War Office, 1906. *Price 2s. each sheet.*

Egypt. **Survey Department, Cairo.**

Topographical map of Giza Province. Scale 1:10,000 or 6·3 inches to a stat. mile. Sheets: N.E., 1–5, 2–5. Cairo: Survey Department, 1904–5. *Presented by the Director-General, Survey Department, Cairo.*

Egypt. **Survey Department, Cairo.**

Provisional map of South-Eastern Desert of Egypt. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. Sheets I. and II. Cairo: Survey Department, 1907. *Presented by the Director-General, Survey Department, Cairo.*

These two sheets are reduced from the 1:100,000 sheets which have been noticed from time to time in the *Geographical Journal*, and include the region between the Red sea and the Nile, extending from 20° to 22° N. lat. They are merely provisional issues, and are printed in blue and brown.

French West Africa. **Service Géographique de l'Afrique Occidentale Française.**

Carte de l'Afrique Occidentale Française. Scale 1:1,500,000 or 1 inch to 23·6 stat. miles. Sheet 1, Sénégal, Mauritanie, partie occidentale du Haut-Sénégal et Niger. Paris: Service Géographique du Gouvernement de l'Afrique Occidentale Française, 1906. *Price* 2.50 *fr. each sheet.*

The first issue of a new four-sheet map of French Senegal and the adjacent regions. This sheet includes the Gambia, the Senegal, and extends north as far as the 22nd parallel of north latitude.

Gold Coast. **Guggisberg.**

Map of the Gold Coast. Published by the authority of Sir John Pickersgill Rodger, K.C.M.G., Governor, under the direction of Major F. G. Guggisberg, R.E., F.R.G.S., Director of Surveys, Gold Coast. Scale 1:125,000 or 1 inch to 1·9 stat. mile. Sheets: 72 K III., Oboase; 72 W I., Sekondi. Edinburgh and London: W. & A. K. Johnston, 1907. *Price 2s. each sheet. Presented by Major F. G. Guggisberg, R.E., Director of Surveys, Gold Coast.*

These are two sheets of a new map of the Gold Coast from surveys made under the superintendence of Major F. G. Guggisberg, R.E., who a few years ago superseded Major Watherston, R.E., as director of surveys in the colony. Aided by a staff of trained assistants, excellent geographical surveys have been lately carried out for the first time on a well-arranged and systematic basis. Without waiting for an elaborate and lengthy triangulation, which would be impossible in this thick forest region without enormous expense, a series of long latitude and azimuth traverses have been run across the country in suitable directions, and with these, supplemented by theodolite angles and route surveys, it has become possible to undertake the construction of a most useful geographical map on a large scale. In fact, this is another excellent example of what can be done under the direction of an experienced surveyor in the way of producing really useful geographical surveys with rapidity and at small expense compared with that of regular triangulation. It is gratifying to know that this sort of work is now progressing in other parts of the British Empire. By the aid of such maps new and unsurveyed regions are now being mapped with sufficient accuracy for all ordinary purposes.

Major Guggisberg is to be congratulated upon the style in which these sheets have been produced. They are clearly printed in colours—water blue, hills chalked in brown, boundaries red, and lettering black. Special care has been taken with the surveying of the mining concessions, the limits of which are clearly indicated. On the left-hand side of each sheet is a most complete, though perhaps somewhat unnecessarily extended, explanatory table of the symbols employed, abbreviations, types of lettering, and notes on the orthography. The sheets have been very creditably engraved and printed by Messrs. W. & A. K. Johnston.

Gold Coast. **Topographical Section, General Staff.**

(Provisional) map of the Gold Coast. Compiled in the Topographical Section, General Staff. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. London: Topographical Section, General Staff, War Office, 1907. *Price 2s. Presented by the Director of Military Operations.*

Togo. **Sprigade.**

Karte von Togo. Bearbeitet von Paul Sprigade. Scale 1:200,000 or 1 inch to 3·1 stat. miles. Sheets: A 2, Tambĕrma; C 1, Bismarckburg. Berlin: Dietrich Reimer (Ernst Vohsen), 1906. *Presented by Herr Paul Sprigade.*

The first of these sheets extends from 8° to 9° N. lat. and from 0° 45′ E. to 0° 30′ W. long., and the second from 10° to 11° 10′ N. lat. and from 0° 45′ E. to 1° 25′ E. long. All available surveys and route sketches have been utilized, and the sheets are printed in colours.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Map of Manitoba, Saskatchewan, and Alberta. Scale 1:792,000 or 1 inch to 12·5 stat. miles. Special edition showing even-numbered sections finally disposed of. Fourth edition, corrected to January 1, 1907. Prepared under the direction of R. E. Young, D.L.S., Superintendent of Railway and Swamp Lands. 3 sheets. Ottawa: Department of the Interior, 1907. *Presented by the High Commissioner for Canada.*

Chile. **Oficina de Limites, Santiago.**

Commission Chilena de Limites. Scale 1:250,000 or 1 inch to 3·9 stat. miles. Sheets: Atacama-Coquimbo, Magallanes, Tierra del Fuego. Santiago: Oficina de Limites, 1906. *Presented by the Director, Oficina de Limites.*

With the exception of the "Atacama-Coquimbo" sheet, the region included in these sheets in the extreme south of Chile in the neighbourhood of Magallan Strait and Tierra del Fuego. As is the case with all the others of this series, which have been noticed from time to time in this *Journal*, each topographical sheet is accompanied by one showing the traverse lines and triangulation of the same area.

United States—Connecticut. **Gregory and Robinson.**

Preliminary geological map of Connecticut. By H. E. Gregory and H. H. Robinson. Scale 1:250,000 or 1 inch to 3·9 stat. miles. New Haven: Connecticut Geological and Natural History Survey, 1906.

ATLANTIC OCEAN.

Azores. **Direcção Geral dos Trabalhos Geodesicos, Madrid.**

Carta chorographica da Ilha Terceira. Levantada pela Direcção Geral dos Trabalhos Geodesicos en 1899. Scale 1:50,000 or 1·3 inch to a stat. mile. Madrid: Direcção Geral dos Trabalhos Geodesicos, 1906.

GENERAL.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams and 105,000 references. Parts 13 and 14. London: The Amalgamated Press, Ltd., 1907. *Price 7d. each part.*

The maps contained in these parts are:—Part 13: Nos. 9–10, Polar Regions; 47–48, Western France; 67–68, Austria-Hungary (industries and communications). Part 14: Nos. 5 6, The Old World; 35–36, Northern Scotland and the Hebrides; 147–148, Cape Colony.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas verkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 47, 48, 49, 50, 51, 52. Gotha: Justus Perthes, 1907. *Price 60 pf. each part.*

These double parts contain the following maps:—Part 47–48, Nos.: 1, Der nordliche Sternhimmel; 67, Ostindinische Inseln (Spezialkarten); 79, Australien, Bl. 3; 98, Süd-Amerika, Bl. 4. Part 49–50, Nos.: 66, Hinter-Indien u. Archipel; 73, Africa, Bl. 5; 90, Vereinigte Staaten, Bl. 5. Part 51–52, Nos.: 2, Der südliche Sternhimmel; 74, Africa, Bl. 6; 85, Vereinigte Staaten und Mexico (Uebersicht); 99, Süd-Amerika Bl. 5

Charts.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during ~~March, 1907~~. *Presented by the Hydrographer, Admiralty.*

New Charts.

No.		Inches.	
121 m	=	1·4	Sweden, west coast:—Torbiornskier to Väderöbod. 5*s.*
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1579 m	=	9·69	New Hebrides. Malekula island, southern portion. Plan added:—Pangkumu bay. 3*s.*

Charts Cancelled.

No.		Cancelled by	No.
121	Sweden, west coast:—Koster islands and approaches to Stromstad	New chart. Torbiörnskier to Väderöbod	121

Charts that have received Important Corrections.

No. 1547, Ireland, west coast:—River Shannon, Sheet II. 1548, Ireland, west coast:—River Shannon, Sheet III. 1541, Ireland, west coast:—River Shannon, Sheet IV. 1549, Ireland, west coast:—River Shannon, Sheet V. 2552, Ireland, south coast:—Dunmanus bay. 1875, Germany:—Elbe, Weser, and Jade rivers. 2302, Baltic sea:—Gulf of Bothnia, Sheet VII. 3300, Baltic sea. Gulf of Riga:—Windau. 798, France, west coast:—Douarnenez bay and approach. 419, Adriatic:—Anchorages and channels in the gulf of Cattaro. 2843*a*, United States, east coast:—Chesapeake bay, Sheet I. 2818, United States, east coast:—Hampton roads and Elizabeth river. 2866, United States, east coast:—Winyah bay and Georgetown harbour. 1217, Gulf of Mexico:—Florida strait, south part. 486, Gulf of Mexico:—Jamaica and the Pedro bank, etc. 1266, Islands and banks between San Salvador and San Domingo. 456, Jamaica:—Port Royal and Kingston harbours. 2600, Leeward islands:—San Domingo to Dominica. 525, Gulf of Mexico:—Boca Grande cay to Tortugas cays. 1329, South America, east coast:—Bahia Blanca to Union bay. 587, Central America:—Burica point to Mangrove bluff. 629, Africa, west coast:—Walfisch bay. 2089, Africa, east coast:—Tugela river to Delagoa bay. 1235, Persian gulf:—Mouth of the Euphrates. 1884, Bay of Bengal:—Arakan river, Akyab. 794, Malacca strait:—Pulo Berhala to Cape Rachado. 2109, Borneo, sheet VI.:—Barram point to Nosong point. 900, Celebes:—Tilamuta harbour to Tanjong Tuladenggi. 1740, China:—Canton river, Sheet III. 1262, China, south coast:—Hong Kong to gulf of Liau tung. 1760, China, east coast:—The Brothers to Ockseu islands. 1761, China, east coast:—Ockseu islands to Tung Yung, etc. 2347, Japan:—Nipon, Kiusiu, and Shikoku, and part of the Korea. 1030, Australia, east coast:—Great Sandy strait, southern portion. 1031, Australia, east coast:—Great Sandy strait, northern portion. 179, New Hebrides:—Espiritu Santo island.

(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian ocean north of 15° S. lat. and Red sea, May, 1907. London: Meteorological Office, 1907. *Price* 6*d. each. Presented by the Meteorological Office.*

KORDOFAN.
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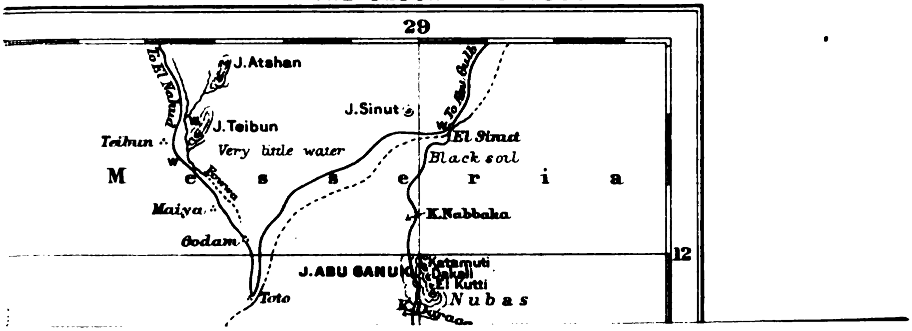
THE GEOGRAPHICAL JOURNAL 1907.



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